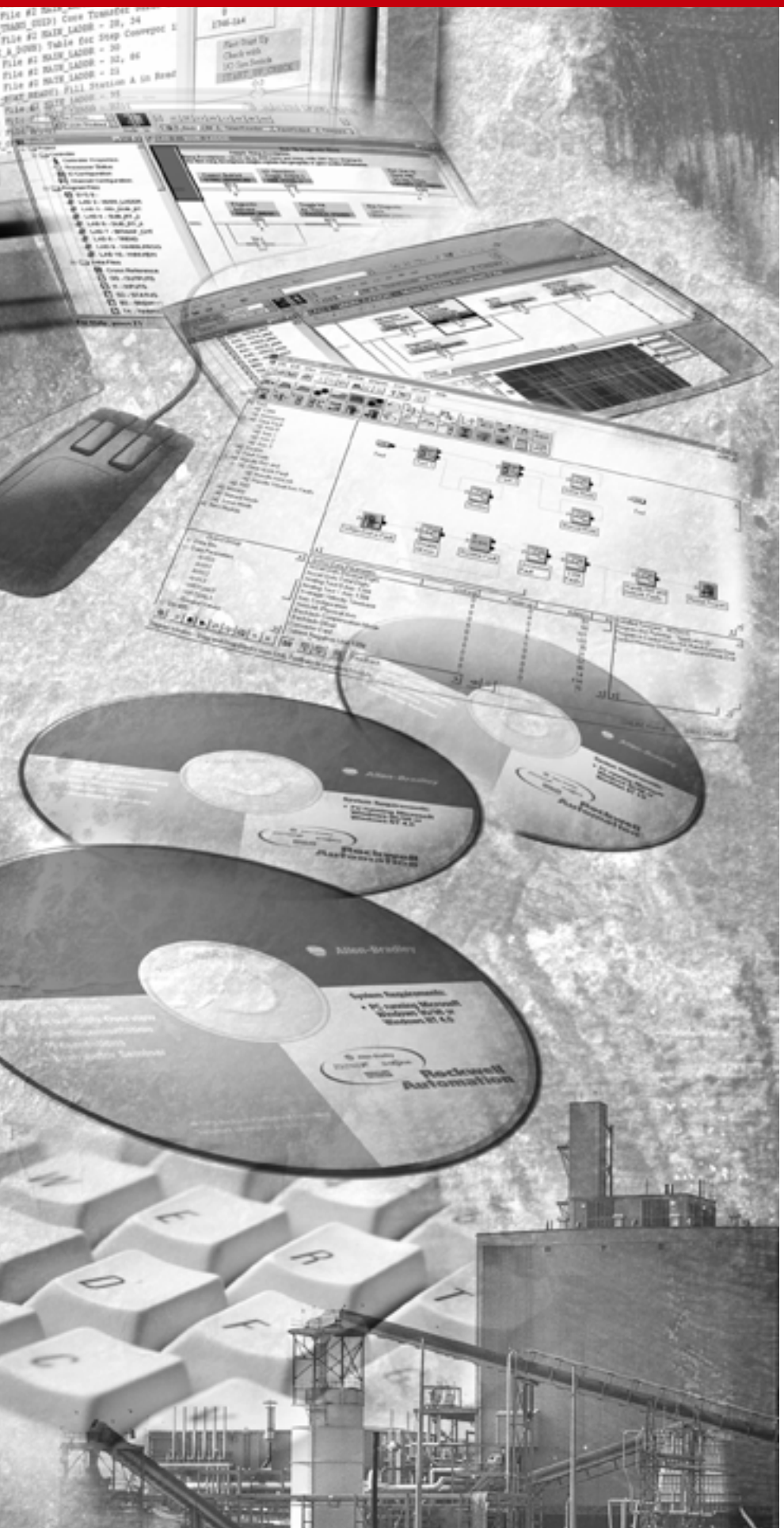

Allen-Bradley

ProcessLogix R320.0 System Overview and Selection Guide

1757 Series

System Overview

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Allen-Bradley is a trademark of Rockwell Automation

European Communities (EC) Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — Generic Immunity Standard, Part 2 — Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

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Rockwell Automation Technical Support

Rockwell Automation offers support services worldwide, with over 75 sales/support offices, 512 authorized distributors, and 260 authorized systems integrators located throughout the United States alone, plus Rockwell Automation representatives in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

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- Network Pre-sales Hotline, 440.646.3638 (3NET)
- Post-sales Technical Support, 440.646.5800
- Web Links
  - http://www.ab.com
  - as a registered member, http://www.ab.com/mem/technotes/techmain.html

Your Questions or Comments about This Manual

If you find a problem or have a comment about this manual, please notify us of it on the enclosed Publication Problem Report (at the back of this manual).

If you have any suggestions about how we can make this manual more useful to you, please contact us at the following address:

Rockwell Automation, Allen-Bradley Company, Inc.
Control and Information Group
Technical Communication
1 Allen-Bradley Drive
Mayfield Heights, OH 44124-6118

Acronyms and Abbreviations

Acronyms and abbreviations used in this document include:

AI – Analog Input

AO – Analog Output

CB – Control Builder

CCL – Control Component Library

CD – Compact Disc

CDA – Control Data Access

CD-ROM – Compact Disc Read Only Memory

CEE – Control Execution Environment

CM – Control Module

1756-CNB or CNB – ControlNet Bridge module

CPM – Control Processor Module

CPU – Central Processing Unit

DI – Digital Input

DNS – Domain Name System

DO – Digital Output

DOS – Disk Operating System

ER – Engineering Repository

ERDB – Engineering Repository Database

FB – Function Block

FSC – Fail Safe Controller

HTML – HyperText Markup Language

I/O – Input/Output

IOM – Input/Output Module

IRQ – Interrupt Request

ISA – Industry-Standard Architecture

LAN – Local Area Network

LED – Light Emitting Diode

MAC – Media Access Control

MB – Megabytes

NTFS – Windows NT File System

NUT – Network Update Time

ODBC – Open Database Communications

OEM – Original Equipment Manufacturer

PC – Personal Computer

1784-PCIC or PCIC – PCI ControlNet Interface Module

1757-PIM – Pulse Input Module

PLC – Programmable Logic Controller

RAM – Random Access Memory

RCP – Redundant Chassis Pair

RTU – Remote Terminal Unit

SCADA – Supervisory Control and Data Access

SCM – Sequential Control Module

SCSI – Small Computer System Interface

1757-SRM or SRM – System Redundancy Module

TC-MUX01 – System Interface Module

TCP/IP – Transmission Control Protocol/Internet Protocol

VGA – Video Graphics Array

WINS – Windows Internet Name Service

Rockwell Automation Logix System:
DCS Process Capability, PLC Scalability and Flexibility

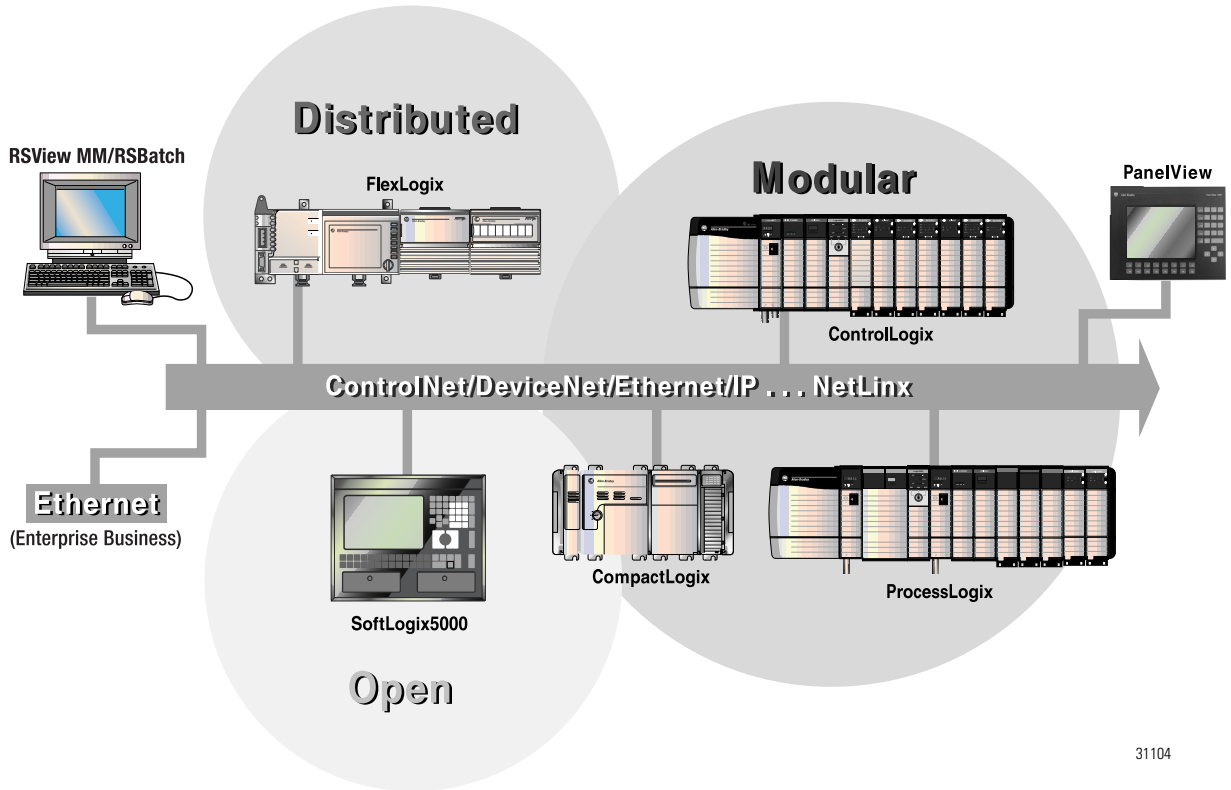
The Rockwell Automation Process Systems

The Rockwell Automation Integrated Architecture allows manufacturers to integrate their entire plant, replacing isolated cells of activity with a single coordinated system that provides robust DCS and PLC control and improves the flow of information, from the simplest sensor on the plant floor to the company's Intranet and Extranet.

Rockwell Automation's Integrated Architecture consists of Logix for control, the NetLinx Open Architecture for communication and ViewAnyWare for visualization. This approach combines products that cross long-standing boundaries between Distributed Control Systems (DCS) used in process applications and the PLC controls typically applied in discrete manufacturing.

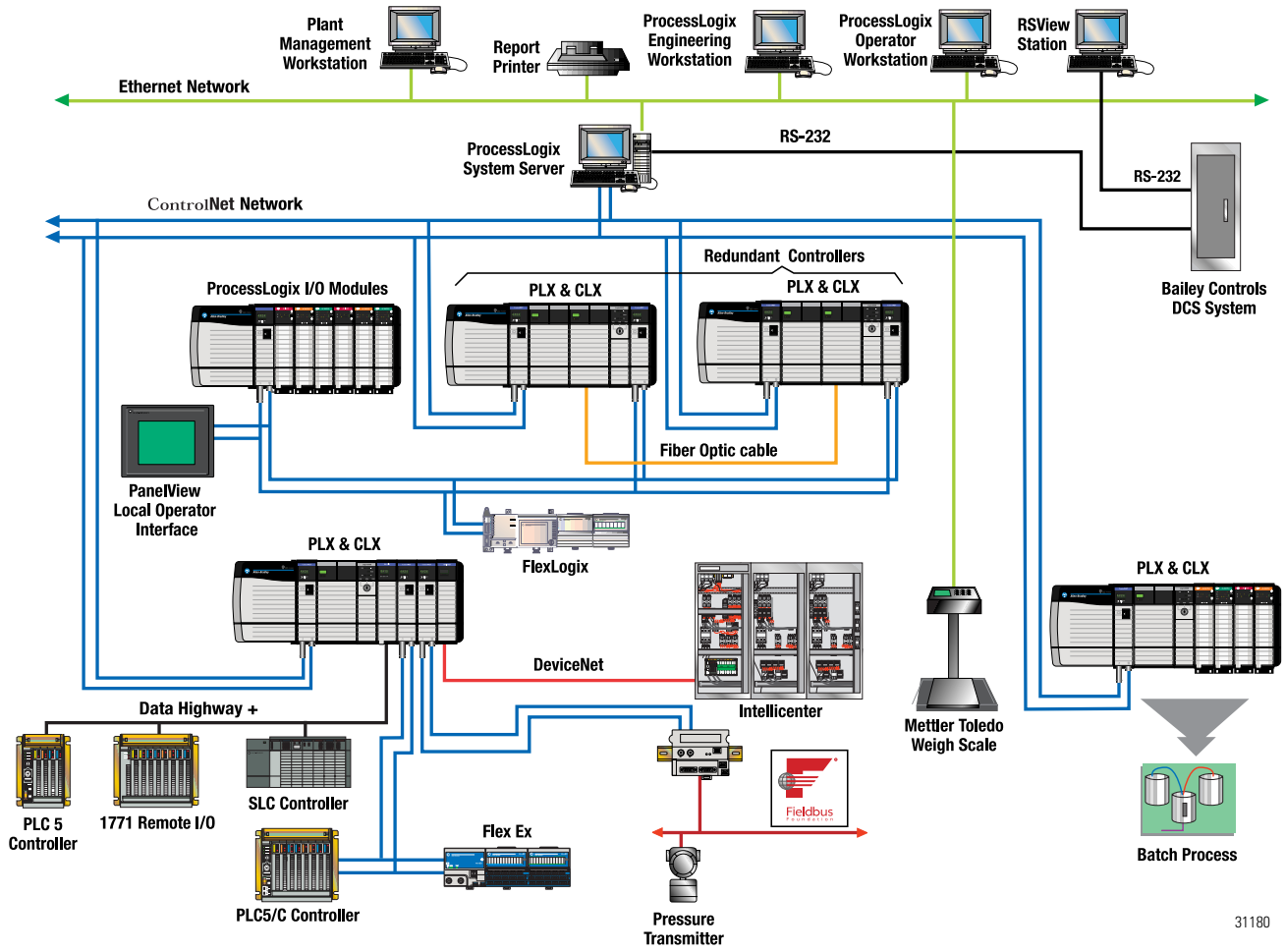
Rockwell Automation's architecture platform is a cost-effective open control system for batch, process, motion, drives and discrete control applications. The Logix architecture system sets a new standard in scalable control systems by providing the highest level of performance, flexibility, and ease of use at the lowest life-cycle cost of ownership.

Figure 1.1 Logix Architecture Overview



Rockwell's Logix system is unique because the same chassis, communication modules, and I/O modules used in ProcessLogix (DCS) are also used by the non-DCS multi-functional ControlLogix. In fact, the two systems, ProcessLogix and ControlLogix work side-by-side, providing a degree of control and openness from a single system never before achieved (See Figure 1.2).

Figure 1.2 Sample Logix System Architecture



ProcessLogix provides the tight integration of human-machine interface (HMI) and control. It also integrates the server-based common database that is typical of DCS systems and required for many process operations.

At the same time, the ControlLogix system supplements this by providing IEC 1131 loop control capability together with high speed discrete and motion control for ancillary operations such as packaging and material handling. And because both share the same I/O data, both control systems will simultaneously reflect events on the plant floor automatically.

Benefits of a Rockwell Automation Logix System

Rockwell's Logix Architecture provides the first hybrid system by integrating the process control of Distributed Control Systems (DCS) and the discrete/sequential control of Programmable Logic Controller (PLC)-based systems.

For those highly integrated analog process applications, you can use the ProcessLogix system out-of-the box to take advantage of pre-engineered system parameters with no need for integration or programming.

Or for the highly customized applications requiring: high speed, regulatory functionality and a significant amount of discrete control, you can use the ControlLogix controller.

In either case, you will benefit from the flexibility typically associated with either controller as well as taking advantage of ControlNet scheduled I/O messaging.

The key is that Logix provides network communications, system development, and control technology.

Unlike other control systems, the Logix system is based on a concept of an open architecture. This automatically allows for:

- bridging of networks without the need for a controller
- placing any combination, arrangement, or quantity of controllers, I/O modules, or communication modules in the chassis
- removal and insertion under power (RIUP) of most modules without disrupting the other modules in the system

For high-speed, motion and discrete control, you can integrate ControlLogix into the ProcessLogix system without using gateways or special interface cards.

Seamless Enables easy integration between different/multiple Logix controllers and with existing PLC-based systems. Users on existing networks can send or receive messages to/from program controllers on other networks transparently.

Fast The Logix architecture provides high-speed data-transfers across the backplane and between the controllers for a high-speed control platform.

Scalable Provides a modular approach to control. Add controllers and communication modules as your system grows. You can have multiple controllers in the same chassis. Select the controller type to meet your application needs.

Industrial Offers a hardware platform designed to withstand the vibrations, thermal extremes, and electrical noise associated with harsh industrial settings.

Integrated Establishes a platform that integrates multiple technologies, including sequential, motion, drive, and process applications.

Compact Meets the needs of many applications where control is highly distributed and panel space is limited.

Flash Upgradeable I/O modules and other device revisions are flash upgradeable using NTools, which flags firmware that needs to be upgradded.

ProcessLogix System for Cost Effective DCS

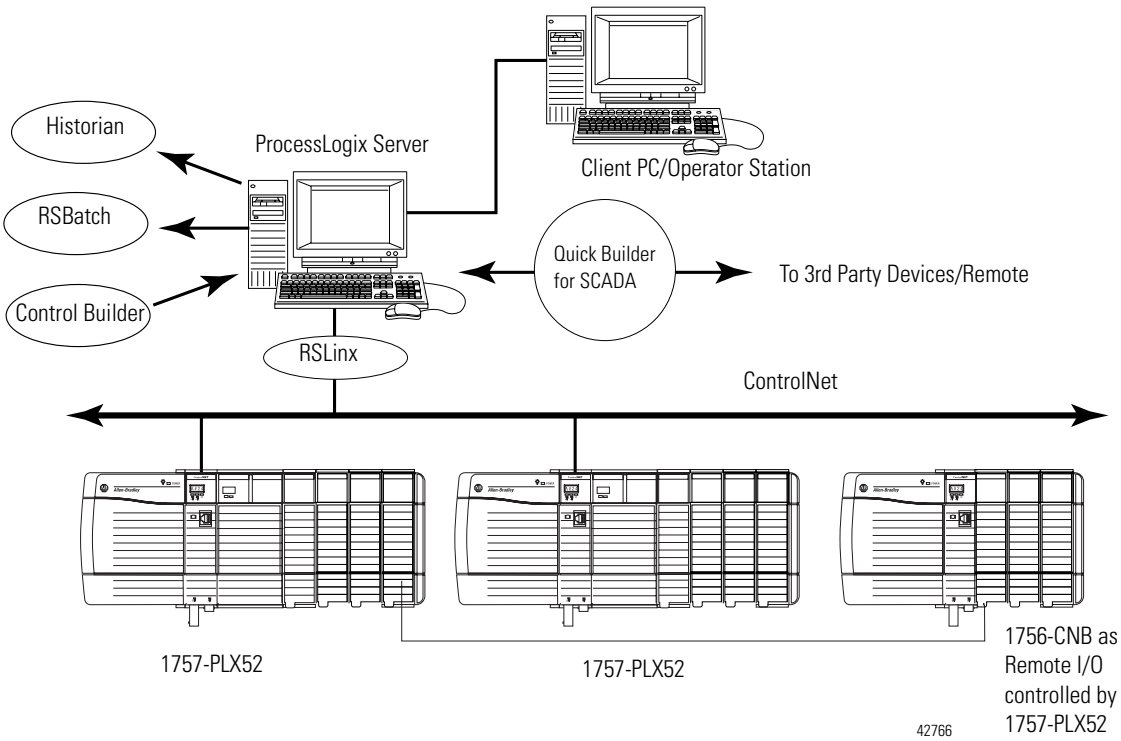
ProcessLogix utilizes current PC/computer technologies that include:

- cost effective PC's using a powerful Microsoft Windows NT-based system Server with dynamic data caching, alarming, human/machine interface, history collection, and reporting functions
- ControlNet, an open, state-of-the-art producer/consumer control network
- Interfaces to legacy Allen-Bradley products as well as third-party devices (SCADA)

- interfaces to a wide range of Allen-Bradley I/O devices, such as FLEX I/O, FLEX Ex modules, PLC-5 processors, and process-specific modules
- object-oriented tools to quickly and easily build reusable control strategies
- development software, including:
  - Control Builder with Continuous and Sequential Control libraries
  - Discrete logic tools and configuration utilities
  - Integrated Operator Interface (OI) displays, custom graphics, alarm diagnostics, history, and reports

With ProcessLogix, you configure the system instead of building it from scratch. Most industrial process control applications call for a number of common elements, such as communications protocols and control algorithms. ProcessLogix has built-in elements within the standard operating framework, allowing you to concentrate on the application, not the integration. See Figure 1.3 for a sample of a standard ProcessLogix System configuration.

Figure 1.3 Sample ProcessLogix System Configuration



The ProcessLogix system lets you start working as soon as I/O and hardware configuration is complete, with a minimum of system

building required. With ProcessLogix, the system is up and running in minimum time.

The ProcessLogix System is built with Rockwell Automation's world-class Allen-Bradley control components. The system features:

- 1757, 1756, 1794, and 1797 series I/O, the most robust in the industry
- widely-used control communication protocols, including:
  - DeviceNet
  - ControlNet
  - Ethernet/IP
  - Data Highway+ (DH+)
  - FOUNDATION Fieldbus
- Optimized controllers for process and discrete control:

Although the ProcessLogix controller has regulatory discrete control capability, often this type of configuration is not enough to solve tough high speed custom control applications, such as packaging.

Network Communication Technology

Common to all of the Logix platforms is a new approach to communication that enables you to control, configure and collect information from all devices on the plant floor. The NetLinx architecture makes this possible in products that connect via EtherNet/IP, ControlNet, DeviceNet and Foundation Fieldbus. The variety of networks available from the NetLinx architecture enables you to choose the type of network, media, devices and topology their application requires, or to mix and match networks as appropriate without adding complexity or sacrificing performance.

Allen-Bradley Communication Networks Overview

NetLinx Communication

Rockwell Automation offers you a choice of networks and a broad scope of products to fit your unique application through its NetLinx Open Architecture.The NetLinx Open Architecture is a combination of network services with a common wire-independent protocol and open software interfaces to help ensure the efficient flow of your information and control data up and down your organization seamlessly.The NetLinx Open Architecture is conceptual and is used to describe these open networks:

- DeviceNet
- ControlNet
- EtherNet/IP

The NetLinx architecture, a combination of wire-independent networks with open software interfaces, helps ensure the efficient flow of your control data and information. The NetLinx architecture is designed to include overlapping device, control, and information networks and bring you a more efficient way to combine these networks without sacrificing performance. Based on your application, you can mix any of the three networks without extra programming or routing tables.

Open indicates that the specifications and technology are not managed or governed by Rockwell Automation.

Control and Information Protocol (CIP) is a major component within the NetLinx open network architecture, and it provides you with four common features:

- common control services - provide you with a standard set of messaging services for all three networks within the NetLinx architecture
- common communication services - let you connect to any network and configure and collect data from any network
- common routing capabilities - save time and effort during system configuration because no routing tables or added logic are necessary to move data between networks
- common base knowledge - reduces the amount of training needed when moving to different networks within the NetLinx architecture by providing similar configuration tools and features

With the NetLinx open network architecture you can:

Control Provides real-time data exchange in a variety of methods: selectable I/O refresh rates, single producer or multi-producer systems, shared inputs, peer-to-peer messaging, and interlocking between controllers.

Configure Able to configure all network devices from any network location. You can configure devices upon start-up, modify device parameters with a click of a mouse or through controller logic without having any impact on control performance. You no longer have to move from network to network for configuration purposes. Now, you can set-up your entire system from one location with one connection.

Collect Provides a perfect solution for HMI display, trending and analysis, recipe management or for maintenance and troubleshooting. This can be done at regular intervals or on-the-fly.

The NetLinx open network architecture is efficient because of its producer/consumer networking services and standard hardware and software interfaces. On producer/consumer networks, if a node needs the packet, it will consume the packet. So the producer sends that packet once, and all the nodes consume the same packet if they need it. This breakthrough brings you:

- increased efficiency because data is produced once, regardless of the number of consumers
- precise synchronization because data arrives at each node at the same time

Open Communication Networks

The Allen-Bradley open communication architecture offers seamless connectivity between plant-floor devices, peer control devices, and business computing systems. Our architecture includes three levels of networks:

- the control and information network, (EtherNet/IP) is an open industrial networking standard that supports implicit messaging, explicit messaging or both and uses commercial off-the-shelf Ethernet communication chips and physical media.
- the control and automation network, (ControlNet) which allows intelligent automation high-speed control devices to share the information required for supervisory control, work-cell coordination, operator interface, remote device configuration, programming, and troubleshooting.
- the device network, (DeviceNet) which offers high-speed access to plant-floor data from a broad range of plant-floor devices with a significant reduction in wiring.

EtherNet/IP, ControlNet, and DeviceNet are open networks. With our open architecture you're not restricted to buying only A-B devices if you implement an A-B network.

Rockwell Automation developed the ControlNet and DeviceNet baseline specifications and made them available to independent organizations who took ownership of the specifications. For example, the Open DeviceNet Vendors Association (ODVA) was formed to take ownership of the specification and support worldwide growth of DeviceNet. To date, more than 400 companies are supporting DeviceNet, ControlNet, and EtherNet/IP products. EtherNet/IP is managed by ControlNet International and ODVA.

Our open communication architecture lets you bring plant-floor data from low-level devices to personal computers and mainframes that run on multiple operating systems.

This table helps you determine which Allen-Bradley networks provide the best solution for your application needs.

Table 1.A Allen-Bradley Solutions for Your Needs

	DeviceNet Network	ControlNet Network	EtherNet/IP Network	Universal Remote I/O Link	DH-485 Network	DH+ Network
Function	Connects low-level devices directly to plant-floor controllers without interfacing them through I/O modules	Supports transmission of time-critical data between PLC processors and I/O devices	Plant management system tie-in (material handling); configuration, data collection, and control on a single high-speed network; time-critical applications with no established schedule	Provides connection between PLC processors and I/O adapters	Provides connection between SLC processors, MMI, and programming devices	Permits plant-wide and cell-level data sharing with program maintenance
Typical Devices Networked	Sensors, motor starters, drives, PCs, push buttons, low-end MMIs, bar code readers, PLC processors, valve manifolds	PLC processors, I/O chassis, MMIs, PCs, drives, robots	Mainframe computers, PLC processors, robots, HMI, I/O and I/O adapters	PLC processors, I/O chassis, drives, PanelView operator terminals, RediPANEL operator modules	SLC processors, PCs, low-end MMIs	PLC processors, PCs, high-end MMIs
Data Repetition	Small packets; data sent as needed	Medium-size packets; data transmissions are deterministic and repeatable	Large packets, data sent regularly	Medium-size or small packets; data sent regularly	Small packets: data sent periodically or as needed	Medium-size packets; data sent regularly
Number of Nodes (max)	64 logical	99	No limit	1 scanner and 32 adapters	32	64 per link (network can have 99 links)
Data Transfer Rate	500, 250, or 125k bit/s	5M bit/s	10M bit/s 100M bit/s	230.4, 115.2, or 57.6k bit/s	19.2 bit/s	57.6k bit/s
Device Suppliers	Open	Open	Open	Rockwell Automation and its partners		
Example Functions	Control, configure and collect data. Networking sensors and actuators to a PLC processor or a PC to reduce field wiring and increase diagnostics	Control, configure and collect data. PLC processor controlling remote I/O chassis, peer-to-peer messaging with other controllers using redundant media connections for time-critical applications	Control, configure and collect data. Using a single PC for data acquisition form many PLC processors, or using a single PC to program up/download multiple PLC processors for non-time-critical messaging between controllers	PLC-5 processor controlling I/O chassis, PanelView operator terminals, 1336 drives, and third-party welders and valves	Programming connection between a PC and one or more SLC 500 processors in a small plant	Using a single PC on one link to program multiple PLC processors on multiple links within a network throughout a plant

The ProcessLogix System

The ProcessLogix system is a modular, supervisory control and networking system designed around the Rockwell Automation architecture and a high-performance, Microsoft Windows NT-based Server. All components of this system are fully integrated. For example, when a user-built Control Module is created and loaded to the controller, required process data parameters automatically loads to both the 1757-PLX52 Control Processor and the Server database. This data processing eliminates the effort normally associated with a component based system, which requires the definition of multiple databases. A Server database point is built for each named block, function, and parameter that you define in Control Builder.

Features like navigation tools and integrated alarming give your system a consistent look and feel from the operator station to the controller. Consistent tag names are used throughout the system which helps to maintain the large amounts of data.

Figure 1.4 The ProcessLogix System

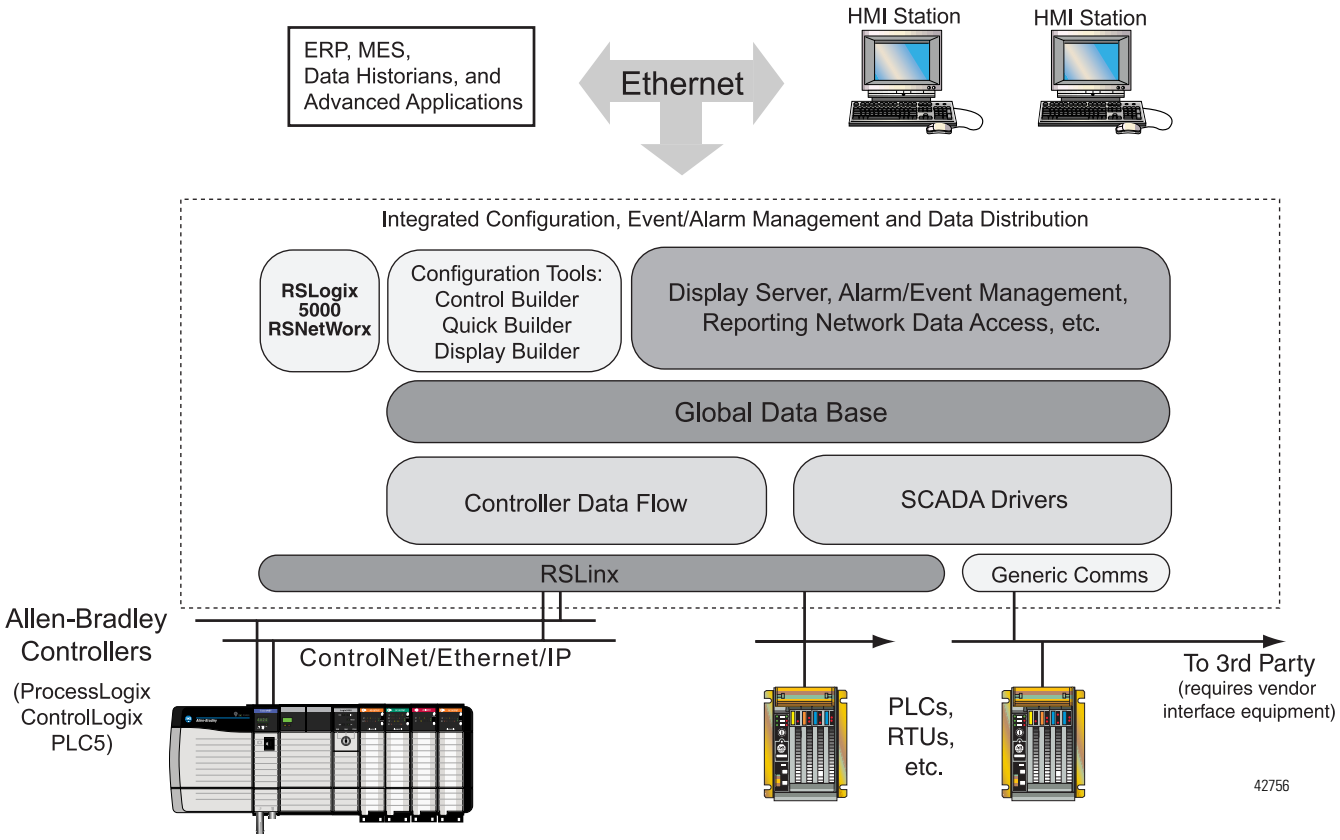


Table 1.B Components of the ProcessLogix R320.0 System

Component:	See Page:
The ProcessLogix Server	1-13
SCADA Interface/Database	1-15
On-line Remote Data Management	1-17
Controller Interfaces and Connection Types	1-18
Human Machine Interface (HMI)	1-19
ProcessLogix System Status Functions	1-21
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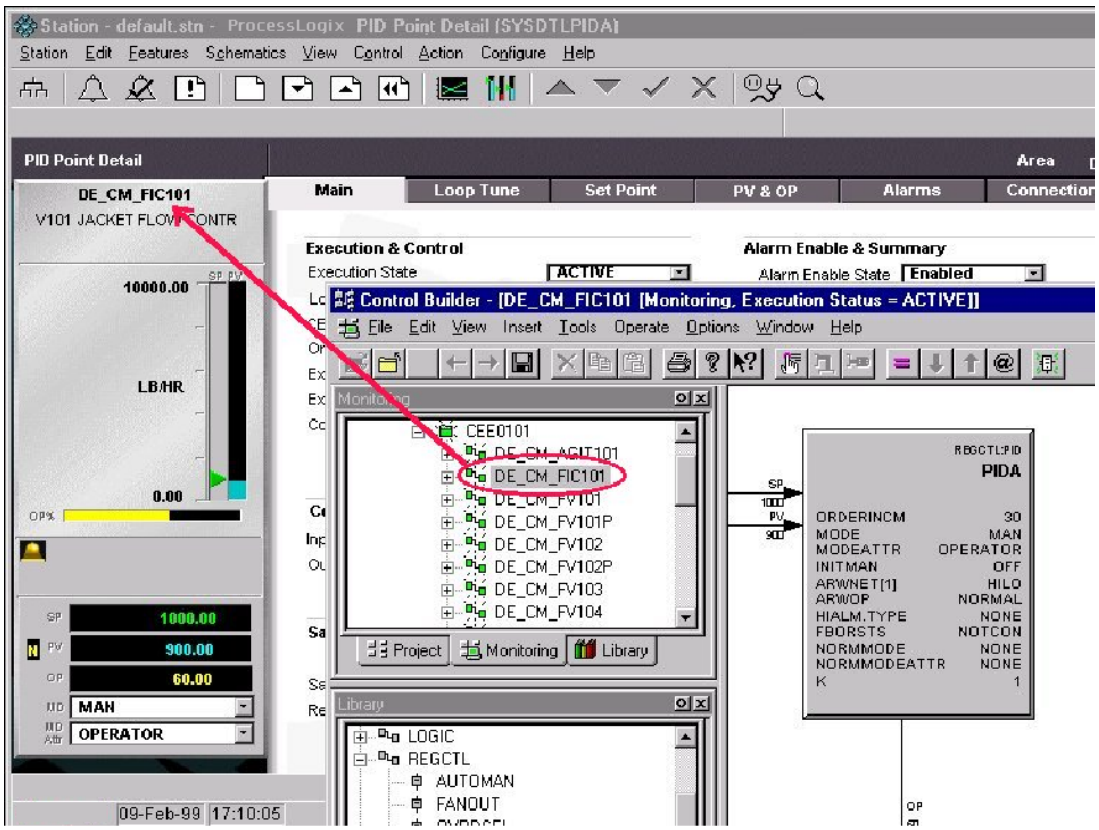
System Development Tools	1-31

Figure 1.5 Controller points are accessible to the operator via standard displays and to MIS via OBDC/OPC.



The ProcessLogix Server

ProcessLogix architecture, the combination of server/ControlNet/ EtherNet/IP ensures that you have complete and transparent access to the Controller database. ProcessLogix also integrates with a wide range of other Rockwell Automation and third-party devices, leveraging existing control investments and enabling complete integration of process information. Process information is accessible by operators, process engineers and MIS level computers, allowing control and monitoring for higher productivity, reductions in costs, higher product consistency, and less waste.

Data Repository

The Server is the system data repository. The common database structure provides an efficient, single source access point for system information. To maintain system performance, a dynamically scheduled cache in the Server gathers all data requests, providing optimal data access performance and memory utilization while minimizing the data access load on the Control Processor.

Controller and Server Configuration

Control Builder configuration includes information for both the Controller and ProcessLogix Server. With an integrated database, information is entered once, not repeated in several databases. The Server features a true Client/Server architecture where a real-time database on the Server provides data to a number of client applications including:

- operator stations
- third-party applications (such as Microsoft Excel, Microsoft Access, LIC Energy)
- web pages

ProcessLogix R320.0 Server Benefits and Features

Through your purchase of the ProcessLogix server, configured by expert technicians at Rockwell Automation, you also recieve the following:

- Rockwell Automation support
- performance consistency
- robust functionality
- reliability

The ProcessLogix R320.0 Server includes the following features:

Windows NT
- Windows NT-based Server and Windows NT or Windows 95/98 based client HMI

Redundancy
- Complete server redundancy
- support for redundant controller/RTU communications

Real Time Access
- real-time data access for a wide variety of process connected devices

SCADA Support
- direct support of SCADA (supervisory control data acquisition) for controllers and remote terminal units

Industry Standards
- industry standard local and wide area network integration

Foundation Fieldbus
- FOUNDATION Fieldbus interface - high level interface to the emerging field industry bus network

Operator Stations
- multiple local and remote operator stations operating as clients from the command database

Sophisticated Built-in Status Functions
- alarm functionality to assist in the management of process systems
- extensive server based historization and trending capability with extensions to 3rd party packages
- flexible standard or customized data reporting
- ActiveX document and scripting support
- secure HTML access within Station window via SafeBrowse
- secure data integration with third party applications

Applied Media
- live video integration

For Server sizing and other specifications, see Chapter 2.

Server Redundancy

As an option, the ProcessLogix Server can be easily made redundant. The ProcessLogix Redundancy subsystem software enables a pair of similarly configured ProcessLogix Servers to support each other in a primary/backup fashion. Primary refers to the specific ProcessLogix Server which is actively acquiring data from the controllers/RTUs and serving data to the clients. Should the Primary fail, a fully functioning Backup assumes the Primary role. The Primary propagates all database transactions to the Backup over a redundant network, so that both databases remain completely synchronized.

SCADA Interface/Database

The ProcessLogix system provides Supervisory Control and Data Acquisition (SCADA) facilities to communicate with a wide range of SCADA controllers and RTUs. See Table 1.C on page 1-18 for a list of controllers/RTU interfaces.

While this capability remains independant from the PLX/CLX system, it extends the functionality of the system by maintaining both the SCADA and the PLX/CLX process data in the same global database This capability also gives the operator access to both the SCADA and the process data.

SCADA Data Acquisition

The process of SCADA data acquisition by the ProcessLogix server has been optimized by using either:

- **Periodic Scanning** ProcessLogix optimizes communication traffic by calculating the minimum number of scan packets required to collect data.
- **Report by Exception (RBE)** This technique is used to reduce the scanning load of the system while improving system response.

If necessary, periodic scanning may be used in conjunction with RBE to ensure data integrity, and optimized data acquisition.

The ProcessLogix SCADA driver provides an interface to third-party devices. The drivers connect the devices to the global database. This connection provides the following standard system structures:

- Analog Point Structure
- Status Point Structure
- Accumulator Point Structure
- User Defined Structure

Using these drivers, each point in the database has a number of associated parameters, all of which can be referenced relative to a single tag name or composite point.

The ProcessLogix server manages SCADA device data in real time database which maintains frequent high-speed access as memory-resident information and other less frequently accessed data as disk-resident data, optimizing the system. Memory resident data is also checkpointed to disk every minute to minimize loss of data in the event of power loss.

SCADA Control Algorithms

In addition to standard point (data) processing functions, the Server provides additional control processing through the use of configurable algorithms that may be attached to an analog, status or accumulator point to allow manipulation of the SCADA information. Functions provided by these algorithms include:

- arithmetic calculations
- boolean calculation
- maximum/minimum value
- integration
- run hours totalization
- group alarm inhibit
- report request
- application program request

On-line Remote Data Management

With administrative privileges, you can view, manipulate and analyze all data in the system from any client/operator station in the system, including those operating remotely via dial-up modem links.

Diagnostics

Once a SCADA controller or RTU is configured and placed in service, diagnostics begin. The Server automatically:

- performs diagnostic scanning of the device
- performs checks on data integrity of all data acquired from the controller
- records errors

  Should an invalid or timed-out response be received, the data is ignored and the transaction is recorded as an error.

- records statistics

  Statistics are kept and displayed by a communications barometer. The barometer increments for every failed call and decrements for each successful call. If a controller fails, all point parameter values that are sourced from it are indicated as bad to the operator.

- activates alarm parameters

  The system alarms separate marginal and failure conditions based on user defined limits to advise the operator of a controller that is in error.

Controller Interfaces and Connection Types

The table below lists the controller and connection types. Refer to the ProcessLogix on-line documentation, *Knowledge Builder* for extensive information about controller connectivity.

Example Controller: An Allen-Bradley Interface

The ProcessLogix system is tightly integrated with the PLC-5/SLC range of controllers. For example, the system provides standard, automatically generated diagnostic displays. In addition any alarms, such as rack faults, major or minor faults, are automatically alarmed in the standard alarm summary display. No configuration is required. The ProcessLogix system also provides complete access to the A-B PD (PID Configuration) or Rockwell Automation Smart Transmitter files when you build a single point.

Table 1.C Interfaces with connection details

Controller/RTU	Connection type
Allen-Bradley SLC5/xx	Serial/Ethernet/DH+
Allen -Bradley PLC-5	Serial/Ethernet/DH+/ControlNet
Allen-Bradley ControlLogix	Serial/Ethernet/DH+/ControlNet
Honeywell S9000	Ethernet
Honeywell LCS620	Serial/Ethernet
Honeywell Data Hiway	Proprietary
Honeywell UDC	Serial
Honeywell Micromax	Serial
Honeywell Flame Safeguard	Serial
Honeywell DPR	Serial
Honeywell XLNET	CBus
Honeywell FSC	Serial and Ethernet
Honeywell FS90	Serial
Honeywell UMC	Serial
Modicon	Serial/Modbus+
AdvanceDDE	Open Standard
OPC Client	Open Standard
Bristol Babcock DPC	Serial
SquareD	Ethernet and Synet
Siemens S5/S7	H1/Industrial Ethernet
Yamatake Honeywell MA500	Serial
Moore Mycro	Serial
Moore APACS	Ethernet & Modulbus
Fieldbus	Open Standard
GE Fanuc Series 90	Ethernet
ASEA	Serial
Universal Modbus	Serial/Modbus+
Applicom	Proprietary
Bailey	Ethernet, SCSI & Serial
Hitachi	Serial

Human Machine Interface (HMI)

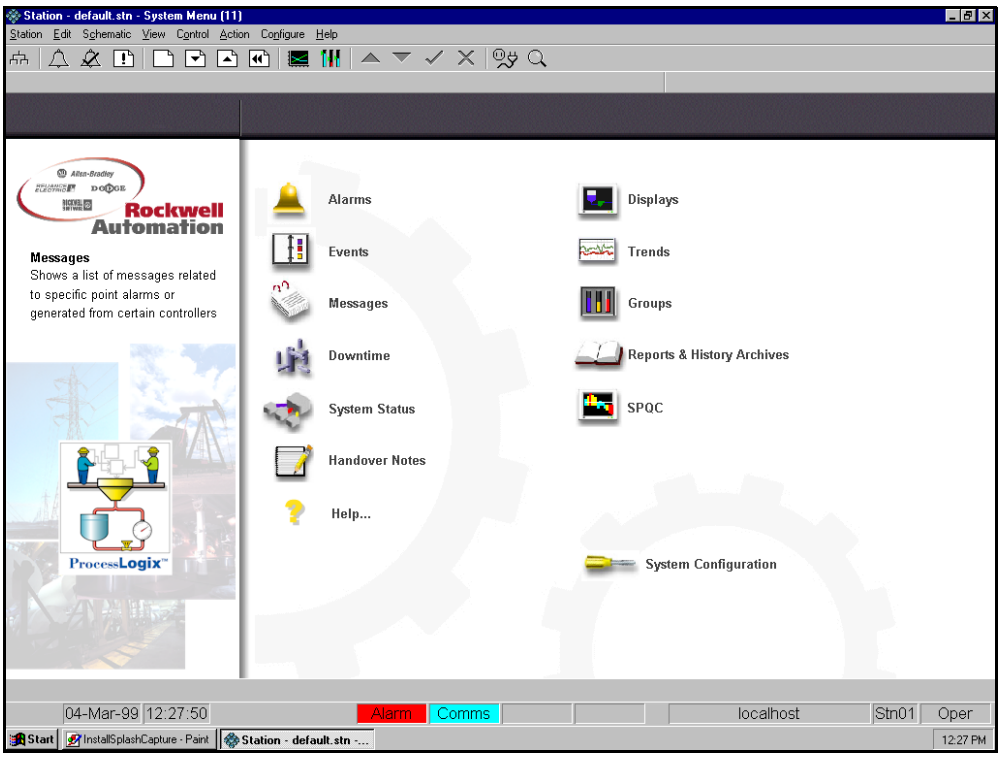
State-of-the-art, object-based graphics provide a powerful interface. The use of industry standards, such as Microsoft Windows NT, Windows 95/98, and the Internet, minimizes operator training by providing a familiar operating environment.

User configurable pull-down menus and toolbars allow easy, intuitive navigation and fast access to key process data. The usability of the operator interface is further enhanced with features such as last command recall, copy and paste, live video integration, ActiveX documents, scripting, launching applications and support for standard peripherals such as:

- Station operator interface software
- sound cards
- touch screens
- dual screens video cards
- pointing devices

Critical information is conveyed using dedicated annunciators for alarms, controller communication failures, operator/controller messages and equipment downtime conditions. An alarm line at the bottom of each graphic shows the most recent (or oldest), highest priority, unacknowledged alarm at all times. Standard system displays make it easy for operators to learn and use the system. See Figure 1.6 for a sample display.

Figure 1.6 ProcessLogix Operator Interface



An extensive range of standard displays available include:

- Menu/navigation displays
- Alarm summary
- Event summary
- Trends
- Operating groups
- Point details
- System status displays
- Configuration displays
- Loop Tuning displays
- Diagnostic and maintenance displays
- Summary displays

ProcessLogix Operator Interface Features

Standard Detail Standard Detail displays for I/O are an example of the 300 standard displays that are included with the system. You can operate from these displays or, if you choose, create custom displays.

Video Integration Live video integration is an important feature where remote sites may be unmanned. ProcessLogix not only allows the operator to view live video from remote locations but also provides the ability to switch cameras, and pan, tilt or zoom the camera to focus in on a particular area. An alternative to live video is WebCam. WebCam allows a CCTV camera to be connected to Ethernet/IP, and is therefore available to all operator stations via SafeBrowse.

SafeBrowse SafeBrowse allows the user to securely browse either the Internet or an Intranet. This allows the system to view corporate documents, such as Standard Operating Procedures, from across the world, or to keep operators informed of relevant product information. SafeBrowse has three levels of security:

- Unrestricted
- Restricted (limited to certain URLs)
- No Access

Rotary Connected Stations Rotary Connected Stations permit any number of operator stations on a network to share a preconfigured number of connections to a ProcessLogix system. This allows a large number of users on a network to access production data on a part-time basis.

ProcessLogix System Status Functions

The ProcessLogix System provides comprehensive alarm and event detection, management, and reporting facilities. Depending on the level of your security authorization (based on logon IDs), you can view, acknowledge and addess alarms from any station. The level of reaction/edits to alarms can also be controlled by security authorizations. One of the keys to operator effectiveness is presentation of alarm information. Many tools are provided to quickly target the process problems, including:

- multiple alarm priorities
- dedicated alarm zone
- associated display
- audible alarms
- alarm cutout
- area assignment
- operator log
- hierarchical alarming
- alarm/event reporting
- alarm/communication/message/downtime annunciator
- alarm priority escalation

Alarm Levels

The ProcessLogix System provides two alarm levels:

- System Level Alarms
  - internal to ProcessLogix based on your system configuration
  - automatically generated on, for example, health of I/O modules, and communication between server and racks
- Process Level Alarms
  - configured and programmed at the Function Block level
  - configured to report on, for example, temperature, flow rates, and sensor functions

Alarm Summary

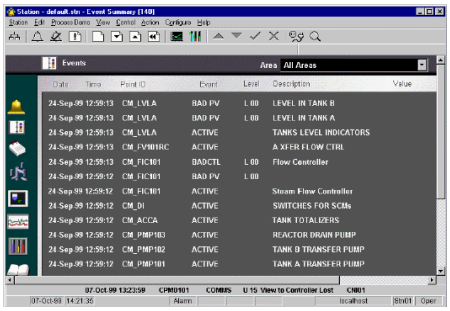
The standard Alarm Summary display allows operators to focus in on the problem at hand by supporting filters. Alarms may be filtered by:

- area
- acknowledge status
- priority

Alarms on the Alarm Summary display can be acknowledged either individually or per page. On custom graphics, alarms can similarly be acknowledged on an individual or per page basis. The standard point alarm behavior is the alarm will flash red if unacknowledged and in alarm and be steady red if acknowledged, yet still in the alarm condition. Up to 4 alarms can be configured for a point. Supported alarms include:

- PV Hi
- PV Lo
- PV HiHi
- PVLoLo
- Deviation Hi
- Deviation Lo
- Rate of Change

Each of the configured alarms can be assigned a priority ranging from Journal, Low, High to Urgent. In addition to the configurable alarms ProcessLogix supports, a range of other point alarms including Control Fail and Control Timeout.



Event Summary

The Event Summary lists all events that occur in the system, including:

- Alarms
- Alarm Acknowledgments
- Return to Normal
- Operator Control Actions
- Operator Login & Security Level Changes
- On-line Database Modifications
- Communications Alarms
- System Restart Messages

Up to 30,000 events may be stored in the Event Summary. The extended Event archiving option enables up to one million events to be stored online, in addition the events can be archived to removable media for access at a later date.

Historization

History collection is available over a wide range of frequencies in both average and snapshot/production formats. A large amount of history can be retained on line, with automatic archiving allowing retention of and access to unlimited quantities of historical data.

The default history collection intervals are:

- 5-second snapshot
- 1-minute snapshot
- 1-hour snapshot
- 8-hour snapshot
- 24-hour snapshot
- 6-minute average
- 1-hour average
- 8-hour average
- 24-hour average

Once collected historical data is available for use by trend facilities, custom displays, reports, application programs, spreadsheets and ODBC compliant databases. Archives can be stored on the local hard drive, optical media, tapes, etc.

Trending

Flexible Trend Configuration allows trends to be configured online as necessary by simply entering the point and selecting the parameter from the database. Any of the history collection intervals may be used as the basis. Standard trend types include:

- Single bar graphs
- Dual bar graphs
- Triple bar graphs
- Multi-plot trends
- Multi-range trends
- X-Y scatter plots,
- Numeric tables
- S9000 and Micromax Set Point Program plots
- Group trends

Functions provided for analyzing and manipulating data include:

- Combination real-time/historical trending
- Trend zooming, panning, and scrolling
- Hairline readout
- Declutter
- Configurable trend density
- Simple recall of archived history
- Trend protection
- Smart clipboard support for copy/paste of data

The declutter feature, for example, enables individual traces on multi-type trends to be temporarily disabled for clearer viewing without requiring reconfiguration of the trace. Trends may be easily configured on line through standard trend displays, without the need to build displays. Real-time and historical data are presented together on the same trend. Archived history may be accessed automatically by simply scrolling to, or directly entering, the appropriate time and date.

Reporting

The supervisory system provides many built-in reporting functions. Standard report descriptions include:

Table 1.D Reporting Functions

Built-in Reporting Functions	Description
Alarm/Event Log	Reports all alarms and events in a specified time period. By using filters, this report provides an operator and/or point trace facility.
Alarm Duration Log	Reports the time of occurrence and elapsed time before return-to-normal for specific alarms in a specified time period.
Integrated Excel Report	Provides the ability to launch a report built using Microsoft Excel in a similar way to all other standard reports. Microsoft Excel can access the ProcessLogix database using the Open Data Access option.
Optional Downtime Analysis	Provides reports of downtime events sorted by category and/or reason codes.
Free Format Report Writer	Generates reports in flexible formats, which may include math and statistical functions such as Max/Min and standard deviation.
Point Attribute Log	Reports on points displaying specific attributes, such as off-scan, bad data, and alarm inhibit.
Point Cross-Reference	Determines database references for specified points to enable easier system maintenance when points are decommissioned or renamed.
ODBC Data Exchange Reports	Reports may be generated periodically, or on an event-driven or demand basis and may be configured on line. Report output may be directed to screen, printer, file, or directly to another computer for analysis or viewing electronically. Refer to Application Enablers on page 1-27.

Security

To maintain system security, ProcessLogix provides configurable security levels, control levels and area assignments. These may be configured for each individual operator or alternatively for each operator station. Up to six security levels limit operator access to ProcessLogix functions, see Table 1.E.

Table 1.E Security Modes

Security Level	Operator Mode
1	Signed-off mode
2	View only mode with alarm acknowledge
3	Level 2 plus control of field parameters
4	Level 3 plus field parameters of Level 4, configure standard system infrastructure such as reports
5	Level 4 plus user configured field parameters
6	Unlimited access

Operator sign-on/sign-off security provides up to 255 control levels to limit operator control of individual items of plant and equipment. Any actions initiated by an operator are logged in the Event database by an operator identifier. In addition any control actions to a given point is only allowed if the control level configured in the operator profile exceeds the level assigned to the point.

An operator password consists of 5-6 alphanumeric characters and is encrypted. Operators may change their own passwords, however a new password can't be the same as the last 10 passwords used in the previous 3 months. When signing on, three unsuccessful attempts will lock the operator out for a lock-out period. Once signed on (logged on), an operator can sign off (log off) at any time or will be automatically signed off after a defined period of inactivity.

Area assignments limit operator access to graphics, alarms and point data to assigned areas, providing effective plant partitioning. Individual operator profiles, including security levels, control levels and area assignments, are activated when operators sign on to the system.

Application Enablers

The ProcessLogix System provides powerful application enablers with configurable (rather than programmatic) facilities to support individual application requirements. Application implementation time is greatly reduced, providing extremely cost effective automation.

Recipe Management Recipe Management lets you create recipes and download them to nominated process units. Each recipe may have up to thirty items, with recipes chained together to form larger recipes if required. Recipe items may be used to set ingredient targets, set alarm limits, set timers and place equipment into correct operating state. Items may be individually enabled for scaling.

Downtime Analysis Downtime Analysis may be used to detect, record and code any equipment breakdowns or process delays to provide plant downtime analysis. A list of all current downtime events is maintained as well as the history of previous downtime events, with each assigned a category and a reason code. Downtime reports may be printed periodically or on-demand, showing downtime duration sorted by categories and reasons.

Point Control Scheduler The Scheduler option allows point supervisory control to be automatically scheduled to occur at a specified time. This may occur once, at a pre-determined interval, or on specific days.

SPQC The SPQC (Statistical Process & Quality Control) option provides powerful statistical processing capabilities for real-time data collected by the system. Facilities include on-line generation of control charts for X-Bar and R-Bar, histograms and Sigma trends, Shewart's calculations for UCL (Upper Control Limit) and LCL (Lower Control Limit), and on-line statistical alarming.

Extended Event Archiving Extended Event Archiving may be used when the events logged by the system are required to be archived for later review. Storage capacity is dependent upon media capacity, but storage of over 1 million events is easily achievable. Approximately 60 Mb of hard disk space is required for every 100,000 events archived.

Alarms and Events Alarms are configured by Control Builder, generated by the Controller, recorded into the event system, and acknowledged by operators on the ProcessLogix Operator Station alarm summary display. Users do not have to separately configure process alarms in both the controller and the supervisory system.

Alarm Pager Point alarms may optionally be sent to an alarm paging or messaging system. Up to 100 pagers can be configured, and each pager has a schedule of operation so that users are only paged when they are on call. The information they receive is what normally appears on the alarm summary. For each phone number configured, the user may specify the days of the week and times of the day that the pager is in use. Points can be scheduled to ring one or more of the configured pagers.

ODBC Data Exchange This option enables two-way exchange of data between the ProcessLogix Server database and an ODBC-compliant local or network third-party database. It uses standard Structured Query Language (SQL) commands. The ProcessLogix Server acts as a client application in this configuration. Information exchanged includes point values, point history, and user file data. Databases that include ODBC drivers include Microsoft SQL Server, Oracle 7, Microsoft Access, and Sybase 10.

Open Data Access Whenever another application requires data from the ProcessLogix database, Open Data Access is required. Some examples of when Open Data Access is required are:

- reading data into a Microsoft Excel Spreadsheet
- running a query on the database from Microsoft Access
- another ProcessLogix system requiring point data
- an OPC Client requires point data
- a user written application is accessing the database

Each of the above instances are considered users of Open Data Access.

The main components of Open Data Access are described below:

ODBC Driver The ODBC Driver allows the Server database to be queried using SQL commands from ODBC client applications, such as Microsoft Access. The Server database is exposed as a number of read-only ODBC tables including Points, Event History and Process History. Driver features include:

- Open read-only access to plant real-time and historical data
- Throttling to prevent performance impact
- Redundancy of data storage
- Fully functional examples for productivity improvements
- Optimized for Microsoft Access and hence other ODBC ad hoc query/report applications.

OPC Server The ProcessLogix OPC Server capability allows a third-party OPC client application to read/write ProcessLogix point parameters. The OPC Server is based on Rockwell Automation's HCI Server toolkit, which in turn is based on OPC specification V1.0a. It supports all mandatory OPC interfaces.

Network Server The Network Server provides extremely efficient, access to the ProcessLogix database for network based applications such as Microsoft Excel Data Exchange, Network Node Interface and Network API options.

Data Exchange Microsoft Excel Data Exchange allows Microsoft Excel to obtain real-time and historical data from the ProcessLogix system. This option provides read and write access to data in one or more ProcessLogix Databases, providing a powerful data consolidation and reporting tool. Wizards for Microsoft Excel are included to help set up the data to be collected.

Network Node Interface When Network Node Interface is licensed on a ProcessLogix Server it can read/write point data to another ProcessLogix Server.

Network API Applications executing on other network connected platforms may easily access ProcessLogix real-time data over the network using the Network API**.** The API provides high level subroutine calls in Visual C/C++ or Visual Basic to allow read/write access to ProcessLogix data in a networked environment.

FOUNDATION Fieldbus FOUNDATION Fieldbus measurement and actuation devices can be integrated into ProcessLogix regulatory, sequential and logic control operation. A ControlNet to FOUNDATION Fieldbus Linking Device allows the powerful ProcessLogix Controller to interface with Fieldbus devices, such as valves, transmitters and sensors. Recent Rockwell testing found that the controller can communicate to eight pressure transmitters via FOUNDATION Fieldbus.

Application Toolkit

Two types of application programming interfaces (API) are available. The first is for applications written on the ProcessLogix Server and the second is for applications that are required to run on network based clients (not necessarily operator stations).

C/C++ The API (programmed in C/C++) on the Server includes the following functions:

- read and write to point parameters in the database
- access to historical data
- initiate supervisory control actions
- access to the alarm/event subsystem
- access to user-defined database
- provide a prompt for operator input

Visual Basic or Visual C/C++ The API (programmed in VB (Visual Basic) or Visual C/C++) on the network-based clients includes the following functions:

- read and write to control module parameters in the database
- access to historical data
- initiate supervisory control actions
- access to user-defined database
- create alarms/events
- Engineering Tools

System Development Tools

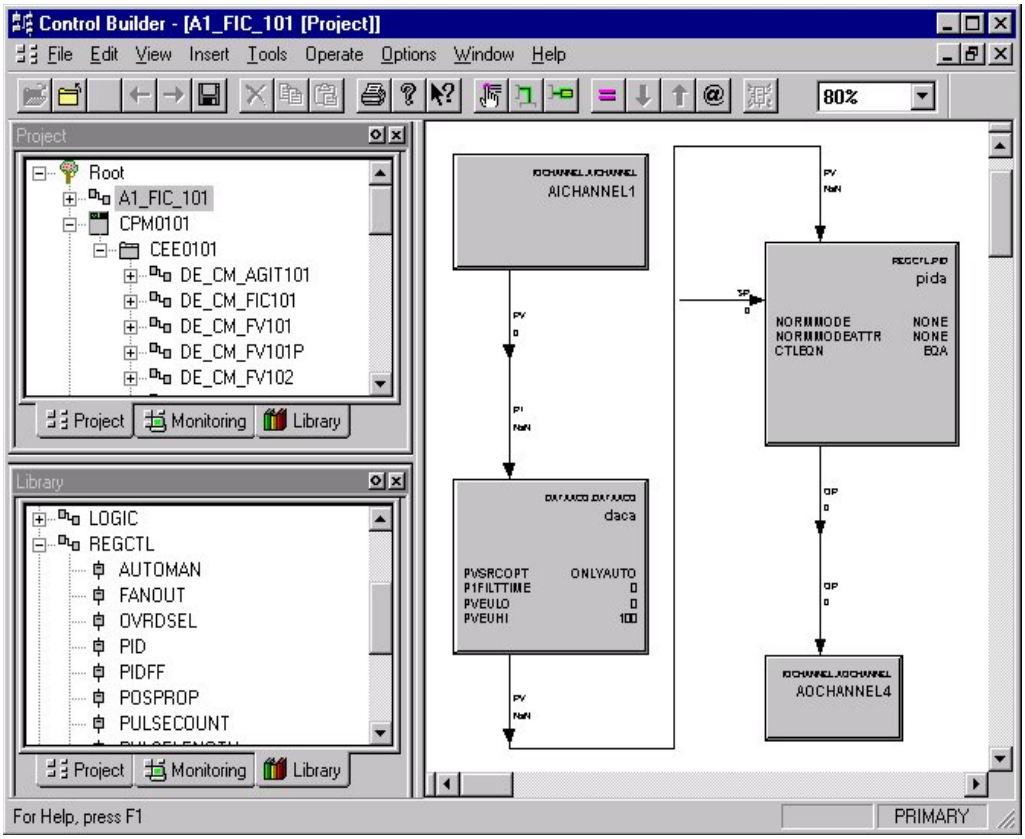
ProcessLogix development software includes the following:

- Control Builder with Comprehensive Control Libraries for process point building and Multiple Workstation use
- Display Builder for powerful operator graphic creation
- RSBatch for powerful batch solutions
- Quick Builder for quick configuration
- Knowledge Builder On-Line HTML-Based Documentation
- Fieldbus Configuration Utilities

Control Builder

Control Builder (See Figure 1.7) is a multi-window GUI object-oriented developmental software, supporting the ProcessLogix 1757-PLX52 Controller system design, documentation, and monitoring. It provides a comprehensive set of tools for handling I/O, continuous, logic, motor, sequential, batch and advanced control functions through a library of Function Blocks (FBs).

Figure 1.7 Control Builder



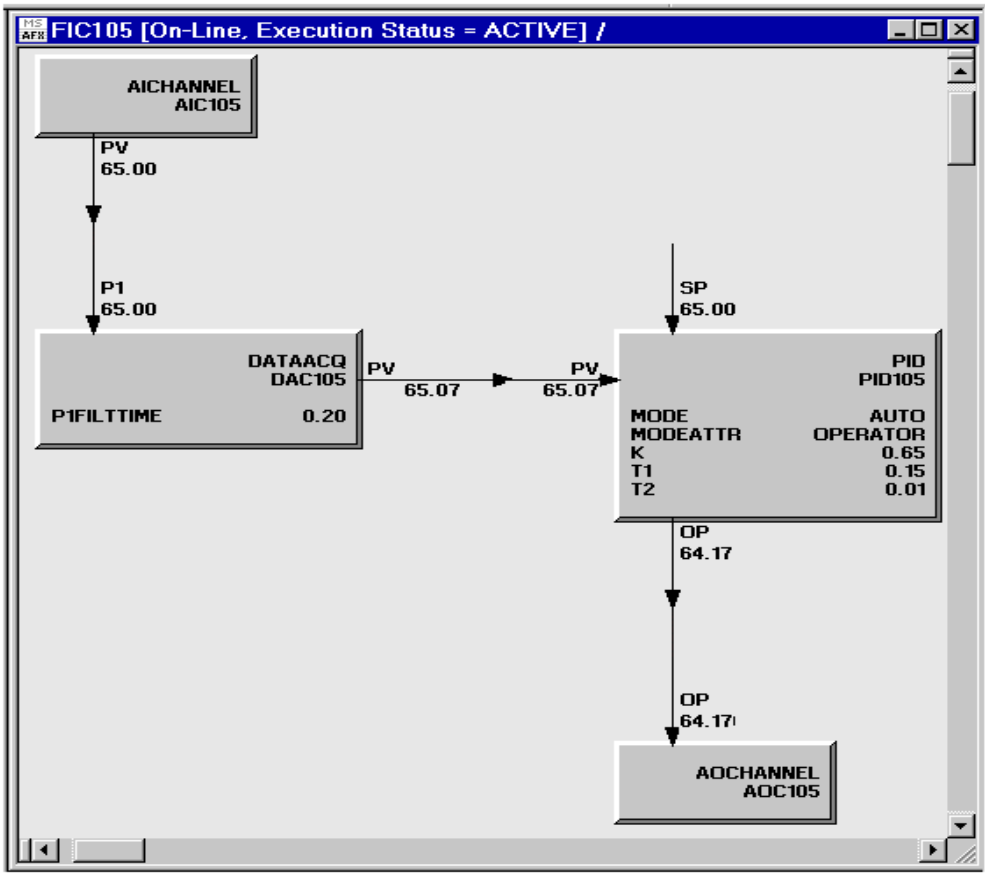
Function Blocks

Function Blocks (FBs) are basic objects provided by Rockwell Automation to execute different control functions. Each block supports parameters that provide an external view of what the block is doing. FBs easily interconnect via “soft wires” to construct control applications or strategies.

Function Blocks are grouped together and contained in Control Modules (CMs) and, in the case of sequential FBs, Sequential Control Modules (SCMs). SCMs greatly simplify batch logic implementation by sequencing a group of process equipment through a series of distinct steps to accomplish one or more process tasks. CMs and SCMs act as “containers” for Function Blocks. This is a very powerful tool for creating, organizing, and checking out control strategies.

See Figure 1.8 for an illustration of a simple Control Module -- in this case a PID loop -- made up of basic FBs. In this example four FBs are contained within the CM named FIC105. You can schedule each Control Module at its own execution rate from 5 msec to 2 sec, and then you can schedule Function Blocks and Control Modules to execute in any desired order.

Figure 1.8 M (PID loop shown) using basic Function Blocks



Control functions currently supported in the ProcessLogix Control Builder Libraries are listed in Knowledge Builder. Types of functions blocks include the following:

Table 1.F Function Block Types and Examples

Function Block Types	Examples	
Genernal Purpose	• Flag • Numeric • Timer • Type Convert Block	• General Purpose Array (Numeric Flag Text) • Message block supports for Operator messages
PV Algorithms	• Data Acquisition • Totalizer • General Linerarations	• PV Calculator • Dead Time • Lead/Lag
Regulatory Control Algorithms	• Proporational, Intgral, Derivative (PID) • PID with Feedforward • Override Selector • Remote Cascade • Auto Manual • Switch • Fanout Block	• Regulatory Calculator • Ratio Bias • Ramp/Soak • Positional Proportional • Pulse Length • Pulse Count
Device Control (Motor Control)		
Discrete Logic (per IEC 1131 standard)	• 2oo3 (2-out-of-3 voting) • AND • CHECKBAD • DELAY • EQ (Compare Equal) • FTRIG (Falling-Edged Trigger) • GE (Compare Greater Than or Equal) • GT (Compare Greater Than) • LE (Less Than or Equal) • LIMIT • LT (Compare Less Than) • MAX (Maximum) • MAXPULSE (Maximum Time Limit Pulse) • MIN (Minimum) • MINPULSE (Minimum Time Limit Pulse) • MUX (Multiplexer) • MUXREAL (Multiplexer, Real Number) • MVOTE (Majority Vote) • NAND • NE (Compare Not Equal)	• nOON (n-out-of-N Voting • NOR • NOT • OFFDELAY • ONDELAY • OR • PULSE (Fixed Pulse Output) • QOR (Qualified OR) • ROL (Rotate Left) • ROR (Rotate Right) • RS (Reset-Dominant Flip-Flop) • RTRIG (Rising-Edged Trigger) • SEL (Selector Function) • SELREAL (Selector Function, Real Number) • SHL (Shift Left) • SHR (Shift Right) • SR (Set-Dominant Flip-Flop) • TRIG (Change Detect Trigger) • WATCHDOG • XOR (Exclusive Or)
Sequential Control Functions (follows S88.01)	• Step FB • Transition FB	• Handlers: Main, Interrupt, Check, Restart, Hold, Stop, Abort
Data Exchange	• Request (Numeric, Flag, Text)	• Response (Numeric, Flag, Text)
I/O Channel	• Analog Input (AI) • Analog Output (AO) • Pulse Width Moduleation (PWM) • Rail I/O Series A (Input & Output)	• Digital Input (DI) • Digital Output (DO) • Serical Interface Array (Numeric, Flag, Text) • Fieldbus Analog & Digital (Input & Output)

Additional function libraries are available as well. The built-in capabilities of the Control Execution Environment (CEE) enable users to take advantage of these library options.

Through the use of Function Blocks, Control Builder:

- enhances engineering productivity by enabling "top-down" implementation, enabling the creation of reusable control strategies,
- uses icons to represent control blocks which can be "wired" together using simple point and click techniques,
- monitors control execution on-line and makes changes to control parameters, thereby significantly simplifying control strategy checkout, and
- allows templates to be created, modified and reused so that control strategies can be built and duplicated with a minimum of effort.

Control Builder also supports a multi-user control strategy development and debugging environment. The function provides the following:

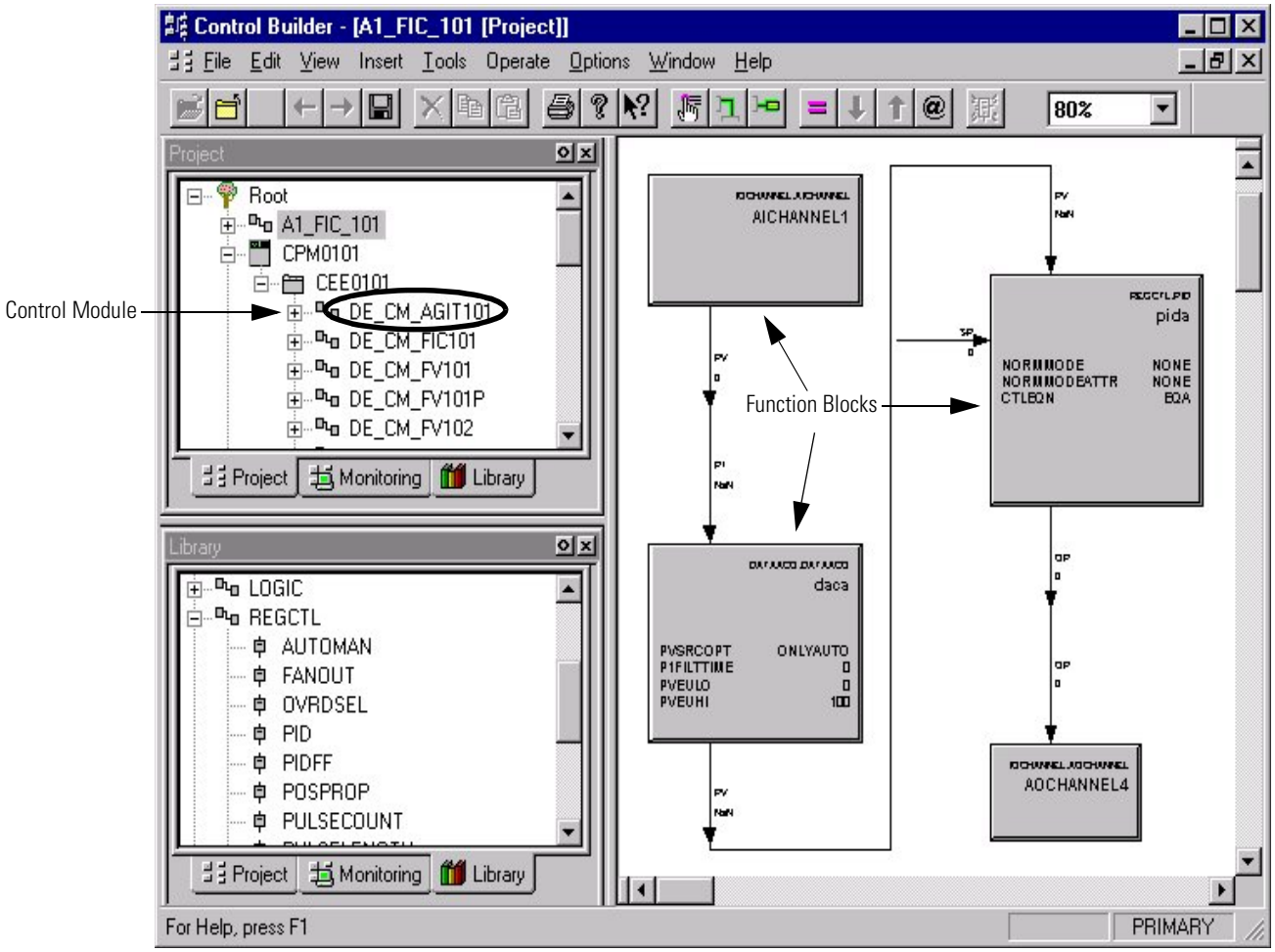
- remote access to engineering databases across any media capable of TCP/IP and UDP/IP communication
- password protected accessibility for maximum security
- several users can create, configure and load control strategies at the same time from different workstations
- multiple users can have the same chart open, with full write access to the first user who opens a chart
- all users can change controller values, based on their security level, when multiple users open a chart for monitoring

What is a ProcessLogix point?

In the ProcessLogix system, each control module is considered a point. In Control Builder, control strategies are developed by placing function blocks into a control module. These function blocks contain data elements that are closely related to the tags in RSView. This means that many RSView tags can be contained within one ProcessLogix point.

The circled control module in Figure 1.9 is represented by the function blocks on the right. Each function block in this control module has a unique set of data elements similar to the tags in RSView. This control module, with all of its function blocks, and all of their data elements, is one ProcessLogix point.

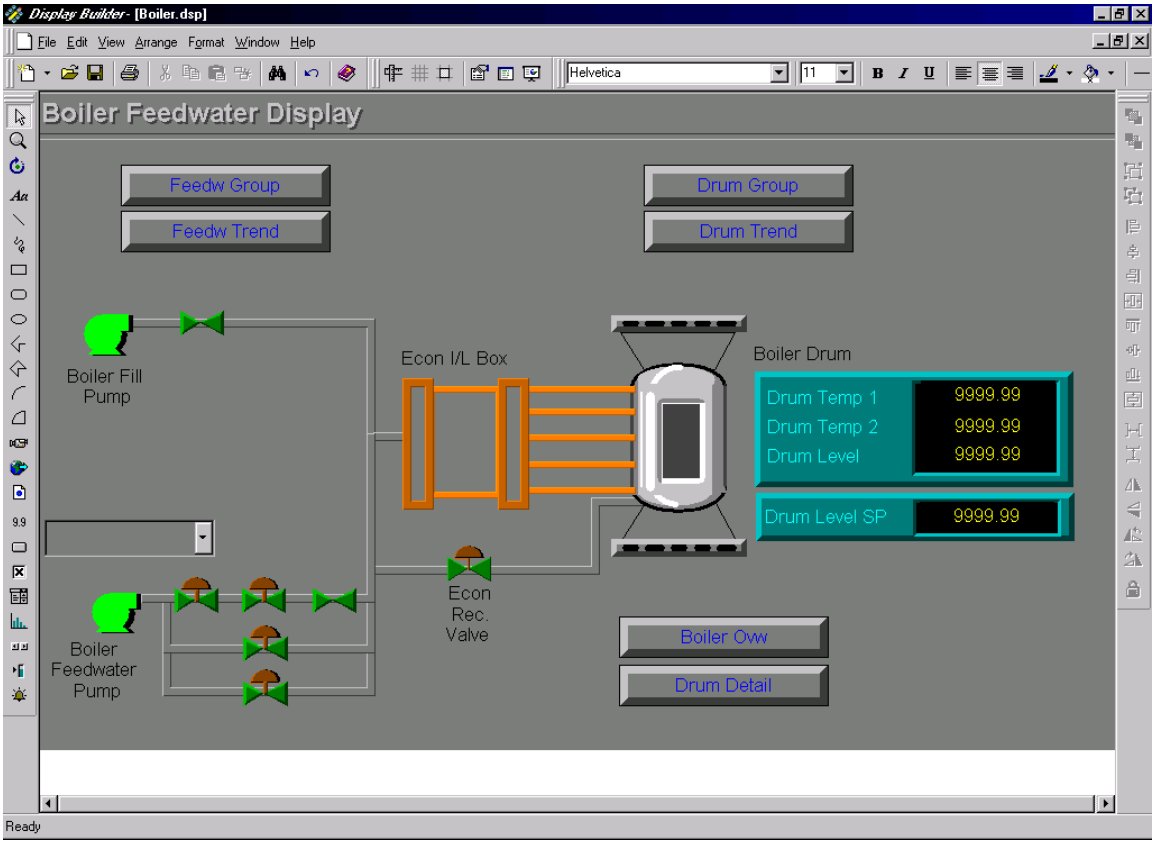
Figure 1.9 A ProcessLogix Point



Display Builder

Display Builder is an object-based, fully integrated custom display builder for development of application specific graphics. Animation of displays is completed quickly and easily with simple point and click type configuration. A library of commonly used plant equipment such as vessels, piping, valves, tanks, motors, etc., is supplied with Display Builder to further speed graphic development.

Figure 1.10 ProcessLogix R320.0 Display Builder Boiler Example



In addition, you can use Template Displays to reduce configuration time where similar displays need to be repeated throughout the system. Process objects and color palettes allow quick and easy creation of custom objects with or without 3D effects.

Graphic displays can be enhanced by using Visual Basic Scripting and ActiveX components. Effects such as high-speed animation, tool tips, and control of a station from an application are possible with VB Scripting. Additionally, a wide array of ActiveX component types, such as playing sound and video can be invoked.

RSBatch

RSBatch for ProcessLogix is one of the most powerful solutions available for batch automation. Developed around S88.01, the Instrument Society of America's (ISA) international standard for batch control, RSBatch uses modular batch automation to make jobs easier for all types of process professionals.

RSBatch allows you to configure physical (equipment) and procedural (recipes) models to execute batches, and to integrate control actions and produciton information with a diverse selection of complementary software.

RSBatch communicates with ProcessLogix through a Sequential Control Module (SCM). The data server, which is included with RSBatch, links to the SCM, giving ProcessLogix a tightly coupled batch system.

For detailed information on RSBatch, see pages 3-11 through 3-21.

Quick Builder

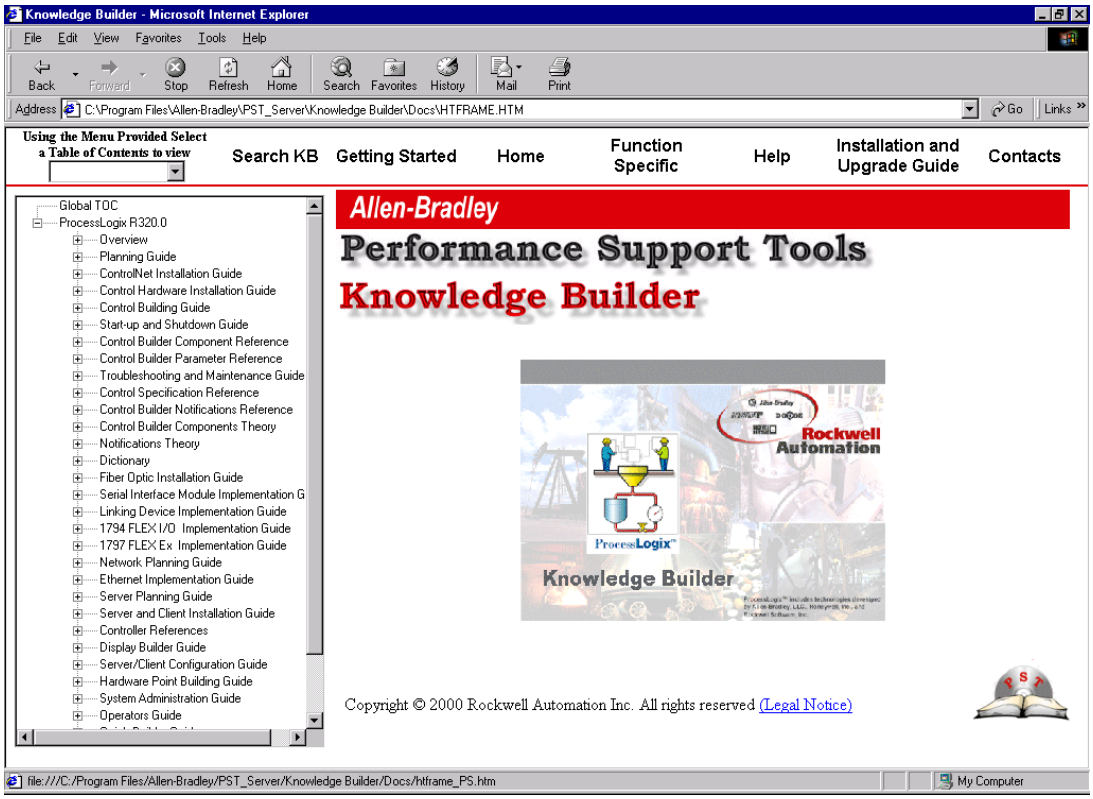
Quick Builder allows users to configure points, controllers/RTUs, stations and printers. Quick Builder leverages a relational database engine (Microsoft Jet Engine) to provide greater productivity through capabilities such as filtering user views of the database, multipoint edit facilities and the intuitive Windows style interface. Other features that the relational database provide are the user-defined fields that can be used for termination schedules, wire numbers, etc., and a standard set of reports.

Additions and modifications to the ProcessLogix system database can be made while the system is on-line.

Knowledge Builder

Knowledge Builder, an on-line resource for system documentation, is supplied with the ProcessLogix system. See Table 1.H on page 1-48 for Knowledge Builder components.

Figure 1.11 ProcessLogix R320.0 Knowledge Builder Performance Tool Main Menu



Fieldbus Configuration Tools

The Fieldbus Configuration Tools integrate the Controller with Fieldbus devices. Key features include:

- Communication through the ControlNet path from the ProcessLogix Server
- Block and Device tag and address setting
- An easy-to-use graphical environment for creating linkages, loops and a schedule based upon Fieldbus concepts
- Configuration of hardware information, ControlNet network addressing, Linking Device paths, Device descriptions, and the base directory to store Device Description information

Determining Your System Configuration

Because the ProcessLogix System is based on Logix products, you have flexibility in determining the type of configuration to use. Use the out-of-the-box hierarchical system for a degree of integration typically associated with DCS applications. Or you can use the system in a flat configuration to emulate PLC-type control.

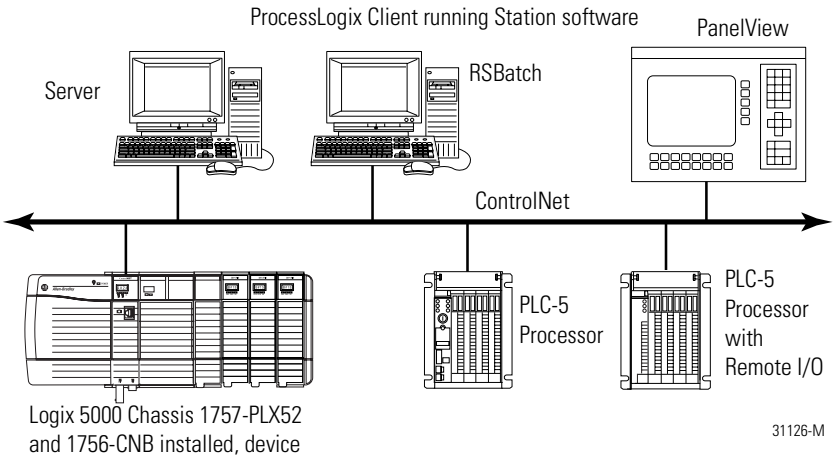
Integrated deterministic network

ControlNet, a real-time process control network, features deterministic data delivery optimized for real-time process control via single or redundant media.

Flat System Configuration

For smaller process applications, a standard ProcessLogix system can be configured as a flat system architecture. A flat system enables you to use ControlNet for both Supervisory and I/O configurations.

Figure 1.12 Flat Network System Architecture

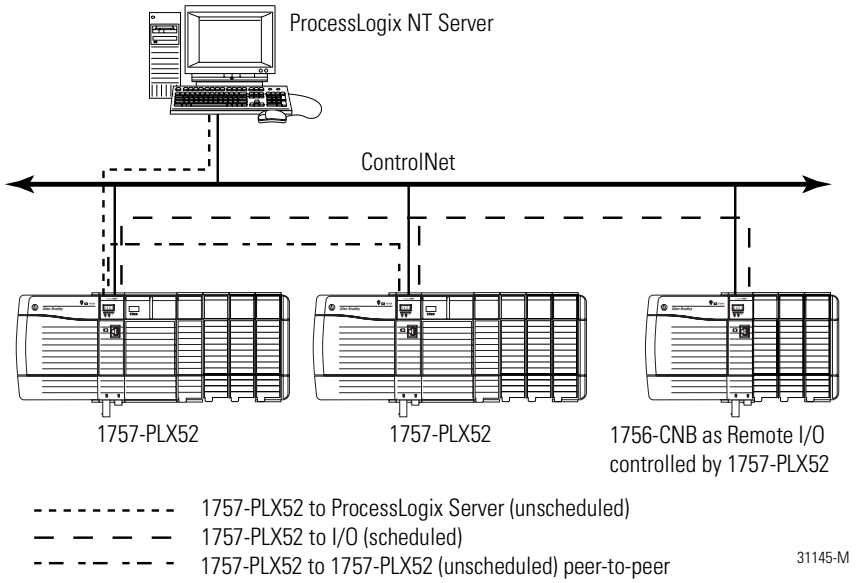


In this configuration, the ProcessLogix System lets you take advantage of ControlNet technology and scheduled I/O messaging to implement a flat architecture.When running several devices on one wire in a flat system, you would use scheduled I/O messaging to optimize your data throughput.

In a flat architecture, I/O data and other information can be transmitted via the same network, resulting in a deterministic network configuration. This configuration requires RSNetworx.

With this network architecture, you need to configure Control Builder to allow I/O modules to be connected through the uplink 1756-CNB in slot 0. With the 1756-CNB in slot 0, Remote I/O can be located in a chassis on the same ControlNet link as the other devices in your ProcessLogix system (e.g., the 1757-PLX52 Process Control Module, the chassis, and the Server).

Figure 1.13 Scheduled I/O messaging on a "flat" system

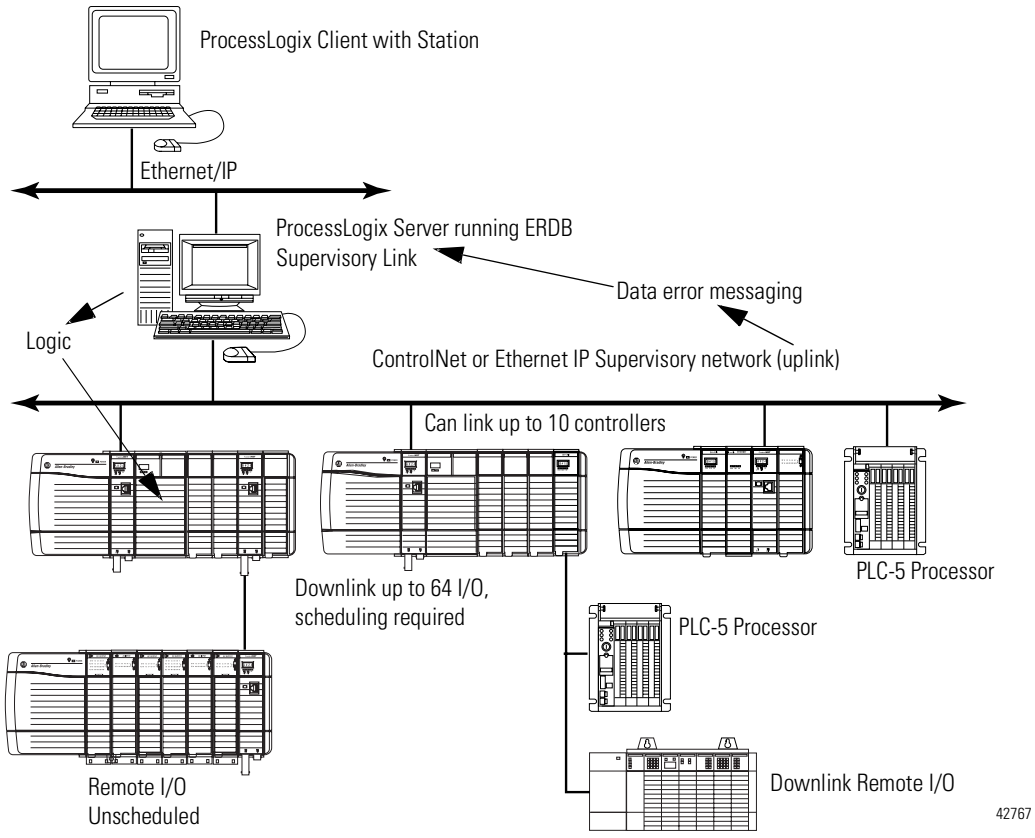


Hierarchical System Configuration

A hierarchical system is one in which communication layers or levels have been established and the communications defined. A typical hierarchical system has three levels, each level has been defined for specific data and:

- **I/O (Remote I/O) Downlink** used to transmit data from I/O devices such as modules to the controller over ControlNet.
- **Supervisory Level** (uplink) designed for inter-controller (peer to peer) and processor data transmission as well as controller-to-server communication and Ethernet/IP. Transmits data such as alarms, event status, etc.
- **Plant/Operator Level** communicates information (rather than raw data) to a human-machine interface (Such as ProcessLogix Station software) for interpretation by the operator.

Figure 1.14 Hierarchical Network System Architecture



Benefits of a hierarchical system include:

- Pre-configuration system parameters
- Parameters defined, no need for additional engineering
- Because the pre-engineered system is sized and tested for the worst "data storm" conditions, you get the I/O updates and data throughput you expect within the specified time

Understanding the Controller, Chassis, and I/O Modules for a ProcessLogix System

1 Power Supply

2 1757-PLX52 Process Control Module

3 1756-CNB ControlNet Interface

4 1756-series I/O Modules

5 1757-SRM Redundancy Module

See below for descriptions of these components and more.

The basic ProcessLogix System consists of standard Rockwell Automation products available through RA distributors. All system components can be used with either the ProcessLogix Process Controller or Logix-based Controllers.

The ProcessLogix Controller has been designed specifically for process control and includes all the features expected and required for sophisticated process applications.

Control hardware includes a Chassis (Rack), Power Supply, 1757-PLX52 Control Processor, ControlNet Interface, Redundancy Module, and I/O Modules. An optional Battery Extension Module (not shown) is also available. The Chassis is available in 5 sizes - 4, 7, 10, 13, and 17 slots.

1 The **Power Supply** is separate from the Rack and does not consume any slots. It is mounted on the left end of the Rack. Both 120/240 VAC and 24 VDC supplies are available.

2 The **1757-PLX52 Process Control Module** is a double wide, two-board assembly featuring a 100 MHz PowerPC processor and eight (8) Mbytes of RAM with error detection and correction. It supports both non-redundant and redundant controller configurations. Four (4) Mbytes of parity-protected Flash ROM is used for permanent program storage and allows easy upgrades. A built-in lithium battery backs up the controller database, and an optional two-slot wide Battery Extension Module provides a rechargeable option instead of replacing the lithium battery.

The Process Controller architecture, featuring the 1757-PLX52 Control Processor, handles a wide variety of requirements, including continuous processes, batch processes, discrete operations, and machine control needs. Compact and cost-effective, the 1757-PLX52 is ideal for integrated regulatory, fast logic, sequential, and batch control applications. Control functions are provided through a library of templates called Function Blocks (FBs). Strategies are easily built using a state-of-the-art graphical engineering tool called Control Builder. Once built, control strategies can be loaded and monitored using Control Builder.

The Process Controller supports ControlNet Interoperability, the capability to communicate with Allen-Bradley controllers like the PLC-5/C and the ControlLogix platform. This allows complete integration of high-speed logic with process control applications. The ProcessLogix Server provides monitoring and supervisory control of ControlLogix processors, PLC and PLC-5 processors from the ProcessLogix Server.

The **Control Execution Environment (CEE)** is the execution and scheduling environment for the 1757-PLX52 Control Processor. It is available in two base execution rates, 50 msec (normal) and 5 msec (fast) and is selected and loaded into the processor with Control Builder, so you can select the execution speed at development time. CEE is the underlying support layer for the execution of all control functions. It features:

- Individual per-module selectable execution rates of 50, 100, 200, 500, 1000 and 2000 msec for the 50 msec CEE and 5, 10, 20, 50, 100 and 200 ms for the 5 msec CEE.
  - all Control Modules and Sequential Control Modules, regardless of function block content, can execute at any of these 6 rates
  - all function blocks within a CM or SCM execute at the same rate

- Configurable phase assignment of any modules executing slower than the base rate. This provides the ability to “load balance” a Control Processor.

- Peer-to-peer communication between 1757-PLX52 Control Processors (PLX555 and other Legacy PLC’s, such as PLC5). Implementation is transparent so that peer-to-peer connections are configured in the same way as intra-controller connections.

The ControlLogix processors (not shown) are single-slot modules which use flash firmware for easy upgrades. These multi-tasking processors feature 32-bit modular memory (available in sizes of 40K, 128K, and 256K), and high-speed logic and sequential performance. The modules contain a mode selection keyswitch, front panel battery access, and a serial port for programming and diagnostics. The following are some of the important features of the ControlLogix processors:

- Seamless integration with existing PLC-based systems, with users on existing networks able to transparently exchange messages with or program processors on other networks.
- Modularity of I/O, memory and communication interfaces provides a configurable and expandable system. You configure your system for the number of I/O, the amount of memory, and the communication networks you need. Later, when you want to expand the system, you can add I/O, memory, or communication interfaces.
- Removal and insertion under power of any module without disruption of any other modules in the system makes it possible to replace a failed module while keeping the rest of the system running.
- Fast delivery of messages between networks, between links within networks, and between modules across the backplane.
- Industrial-hardened hardware platform is designed to withstand the vibrations, thermal extremes, and electrical noise associated with harsh industrial environments.
- Compact design of hardware lets it fit in limited panel space.
- Multiple processor modules can be plugged into the same backplane. The high-speed backplane provides for easy access of data by each processor from the other to share I/O values and other information.
- Distributed processing is possible by connecting processors across EtherNet/IP, ControlNet, and DeviceNet networks.
- Distributed I/O at locations remote from the processor can be connected across EtherNet/IP, ControlNet, DeviceNet, and Universal Remote I/O links.

- The IEC-1131-compliant operating system provides a true pre-emptive multi-tasking environment, allowing you to meet your application requirements with software components scheduled individually. This increases the efficiency of the processor and saves money by reducing the number of processors needed for your overall control system.

- Motion control is integral to the ControlLogix processor. This highly integrated operation is made possible by the high-speed backplane over which the processor communicates with a servo interface module where the positioning loop and velocity loop are closed. The ControlLogix processor has the motion commands embedded in it. These commands support a range of motion functions from simple point-to-point moves to more complex gearing moves. The same RSLogix 5000 programming software that provides ladder logic programming for sequential control provides complete programming and commissioning support for motion control. This approach results in faster development and integration and easy start-up and troubleshooting.

3 The **ControlNet Interface (1756-CNB)** links the Controller with either of two ControlNet Process Control Networks. ControlNet is an open, flexible, high performance network supporting Supervisory/Peer (controllers to HMI) Peer-to-Peer and I/O Network communications. The ControlNet specification is owned and managed by ControlNet International, of which Rockwell Automation is a founding member.

Table 1.G ControlNet Interface Specifications

1756-CNB Specifications	
data throughput	5 Mbits/sec. via single or redundant media options and features deterministic data delivery
physical media	RG6 coaxial with BNC connectors in a trunk-and-drop, bus topology
total possible network length	10 km, using fiber optic repeaters, and 6 km, using coax cable and repeaters
maximum coax network segment length	1 km (dependent on number of taps and drops)
maximum fiber network segment length	3 km (dependent on fiber grade)
each Supervisory/Peer Network segment supports	up to 6 non-redundant or 4 redundant controllers
each Control Processor can connect to	up to 8 I/O chassis via the I/O Network

4 **ControlLogix 1756-series I/O Modules** are a rack-mounted (chassis) family of I/O available in a wide variety of densities. Modules have a small form factor (5" x 5") and feature deterministic I/O update rates, diagnostics features, local (front of module) or remote terminations, and software configuration/management support. Available modules and specifications are listed in publication 1757-SR002A-EN-P, ProcessLogix System I/O Specifications, included in this binder**.**

FOUNDATION Fieldbus Linking Device (not shown) connects the FOUNDATION Fieldbus H1 network with ControlNet. This allows each Controller (PLX, CLX, or PLC) to access data and control Fieldbus devices, enhancing the power of ProcessLogix's Controller.

FLEX Ex Galvanic Isolation/Intrinsic Safety (GI/IS) I/O (not shown) provides a compact family of I/O that can be mounted and operated in areas with potentially explosive (Ex) atmospheres. All of the FLEX Ex components are certified and can easily be distributed throughout a given hazardous location. Corrosion protection to test level G3, according to ISA-S71.04-1985, is a standard feature of FLEX Ex I/O components. Refer to publication 1757-SR002A-EN-P, ProcessLogix System I/O Specifications, for FLEX Ex I/O specifications.

5 **The Redundancy Module (1757-SRM)** provides redundancy between two controller chassis. Synchronization of primary and secondary is completely transparent to the user, and control switchover time in the event of a system failure is negligible. The Redundancy Module, which connects to its redundant partner via fiber optic cable, can be replaced on-line without disrupting control of the user's process. The following are some of the important features of the SRM:

- **transparency of synchronization** Control chassis synchronization does not cause any user perceived control interruption. The redundant control system automatically synchronizes a secondary solely by powering up a properly cabled and populated secondary control chassis.
- **transparency of switchover** The occurrence of switchover of the control chassis is unnoticeable to the operator, unless triggered by an alarm or an event. Control interruption time is negligible.
- **user commanded switchover** The user can force a switchover condition if desired.
- **guaranteed store** Communication transfers are not acknowledged as successful unless both the primary and a synchronized secondary (if present) receive the message.

- **output coherency on switchover** All outputs remain unchanged during a switchover with no bump to the process. Switchover does not cause outputs to revert to a prior value.

- **reaction to impending chassis power loss** Upon detection of power loss, the SRM (a) notifies its partner and initiates a switchover, (b) records the power loss event in its non-volatile event log and (c) halts normal operations to prevent memory corruption.

- **fault isolation** A single fault does not propagate from a control chassis to its partner to cause the control system to cease to control properly.

- **one module design** 1757-PLX52 and/or ControlLogix modules can be used either with or without the SRM for both non-redundant and redundant applications.

- **partner failure diagnosis** The cause of a failure in one controller chassis can be diagnosed from the SRM in its partner chassis.

- **redundancy module on-line replacement** The redundancy module can be replaced on-line without disrupting control of the user process.

The controller, I/O system and all of its components are approved for mounting in Class I, Division 2, Groups A, B, C, and D areas and fully meet stringent industrial CE-Mark (European Community) immunity and emissions requirements.

ProcessLogix User Documentation

ProcessLogix documentation is available in these formats:

- **On-line Help** (F1 function key from within several applications)

- **Knowledge Builder** Electronic On-line Documentation using HTML Frame Browser. See Table 1.H.

- **ProcessLogix R320.0 Software/Documentation Kit** contains ProcessLogix Software and Knowledge Builder CDs as well as publications necessary to install and use the software. This kit is updated with every release of ProcessLogix Software. Contact your Rockwell Automation representative or distributor for ordering information.

Knowledge Builder Documents

The following table lists components of the electronic ProcessLogix Knowledge Builder:

Table 1.H ProcessLogix Knowledge Builder Electronic Documentation

Electronic Document Component	Description
ProcessLogix Guides	
Overview	A comprehensive overview of the ProcessLogix System.
Planning Guide	Covers all aspects of ProcessLogix System planning.
ControlNet Installation Guide	Procedures for installing all Control System related cabling, wiring, and associated hardware components.
Control Hardware Installation Guide	Procedures for installing controller, I/O, communications, and special function modules.
Control Building Guide	Procedures for configuring a ProcessLogix control strategy. Includes guidelines on how to build detail displays with a reference to the ProcessLogix Display Building Guide.
Start-up and Shutdown Guide	Procedures for normal start-up, shutdown, and restarts, including controller and networks.
Troubleshooting and Maintenance Guide	Procedures for troubleshooting and maintenance, with diagnostic information.
Rail I/O Implementation Guide	Provides information about the RIOM-H (GI/IS) components as a supplement to existing procedures.
ProcessLogix Reference	
Fieldbus Implementation Guide	Procedures for interfacing FOUNDATION Fieldbus devices with ProcessLogix's Controller.
Server and Client Installation Guide	Procedures for installing Server and Clients.
Server and Client Configuration Guide	Procedures for configuring Server devices, points, reports etc.
Operators Guide	Procedures for operating Station, including monitoring and controlling, managing alarms, and generating and viewing reports.
Administration Guide	Procedures for system administration, including topics such as security and system back-ups. Incorporates SCADA and Process System administration information.
Statistical Process & Quality Control	Procedures for implementation of SPQC
Application Development Guide	Procedures for writing Server applications.
Display Building Guide	Procedures for building custom Server displays.
Quick Building Guide	Procedures to create and modify configuration databases, which define how system items, such as Stations and points, are set up.
Control Builder Component Reference	General information on control module components (how they work).
Control Builder Parameter Reference	Detailed information on Control processor module and function block parameters.
Control Specification Reference	Detailed process specification information for ProcessLogix System.
Control Builder Notification Reference	Describes error codes generated from within Control Builder.

Table 1.H ProcessLogix Knowledge Builder Electronic Documentation

Electronic Document Component	Description
Hardware and Point Building Reference	Detailed reference for ProcessLogix SCADA Server hardware and points.
Controllers Reference	Comprehensive reference guide to all SCADA drivers.
ProcessLogix Theory	
Communications Theory	Covers all aspects of ProcessLogix communications, including Controller peer-to-peer.
Control Builder Components Theory	General information on control module components (how they work).
Notifications Theory	General notifications theory information (how it works).
ProcessLogix General Information	
Supporting Information	
Frequently Asked Questions	Answers to frequently asked questions about the ProcessLogix System.
Rockwell Automation Contacts	Lists identifying important contacts within Rockwell Automation.
Other Resources	
WWW Resource Links	Provides links to important web sources of information.
Getting Started	A complete guide to getting the ProcessLogix system up and running.
Help	Provides Knowledge Builder Help.
Dictionary	Dictionary of terms and acronyms used in ProcessLogix.
Global Table of Contents	Complete Table of Contents for Knowledge Builder.
Site Docs	Site Docs allows the user to add links to site-specific electronic documentation within Knowledge Builder. A trial version of Site Docs is included.
Search Engine	Extensive search capability for Knowledge Builder data base.
Functions Block Home Pages	Control Builder Function Block reference providing examples, detailed theory, etc.
Training	Training course schedules, enrollment information, course outlines and more.

Related User Documentation

Integrated on-line documentation

The ProcessLogix system gives users quick access to system information and support using the latest Internet technologies. It features SafeBrowse, Internet-aware HTML (hypertext markup language) documentation, on-line help and on-line technical support. Users won't need to search through multiple sets of documentation. SiteDocs allows users to add links to site specific electronic documentation within Knowledge Builder.

Publications for various Logix system components are available from Rockwell Automation. Most publications, such as Installation Instructions, typically ship with the product. You may also order documents from Rockwell Automation's Automation Bookstore website at www.theautomationbookstore.com. You can either:

- download a .pdf (Portable Document Format) file for viewing and printing, or
- place an order for a printed copy of the publication

See Table 1.I for a list of related user documentation you may want to order.

Table 1.I Related User Documentation

Document	Pub Number	Description
ControlLogix Documentation		
ControlLogix System User Manual	1756-UM001B-EN-P	Operating information for the Logix5000 Processor.
I/O Module Documentation		
1756-series I/O		
Analog I/O Modules User Manual	1756-6.5.9	Operating instructions for 1756-series analog I/O modules, including: 1756-IF16, -IF6I, -IF8, -IR6I, -IT61, OF4, OF6CI, -OF6VI, -OF8.
Digital I/O Modules User Manual	1756-6.5.9	Operating instructions for 1756-series digital I/O modules, including: 1756-IA16, -IA16I, -IA8D, -IB16, -IB16D, -IB16I, -IB32, -IC16, -IH16I, -IM16I, -IN16, -OA16, -OA16I, -OA8, -OA8D, -OA8E, -OB16D, -OB16E, -OB16I, -OB32, -OB8, -OB8EI, -OC8, -OH81, -ON8, -OW16I, -OX81.
1757-series I/O		
1757-PLX52 Installation Instructions	1757-IN091A-US-P	Installation instructions for the Process Logix Process Controller Module.
1757-SRM Installation Instructions	1757-IN092B-US-P	Installation instructions for the ProcessLogix Serial Redundancy Module.
1757-BEM Installation Instructions	1757-IN093A-US-P	Installation Instructions for the ProcessLogix Battery Extension Module.
1757-PIM Installation Instructions	1757-IN900A-US-P	Installation Instructions for the ProcessLogix Pulse Input Module.

Table 1.I Related User Documentation

Document	Pub Number	Description
1794-series I/O		
1794-IA8 Installation Instructions	1794-5.9	Installation instructions for the 120V ac 8 input module.
1794-IB16 Installation Instructions	1794-5.4	Installation instructions for the 24V dc 16 sink input module.
1794-OB16 Installation Instructions	1794-5.3	Installation instructions for 24V dc 16 source output module.
1794-OV16 Installation Instructions	1794-5.29	Installation instructions for the 24V dc 16 sink output module.
1794-OA8 Installation Instructions	1794-5.10	Installation instructions for the 120V ac 8 output module.
1794-IE8/B User Manual Installation Instructions	1794-6.5.2 1794-5.6	Installation and operating instructions for the 24V dc selectable analog 8 input module.
1794-OE4/B User Manual Installation Instructions	1794-6.5.2 1794-5.5	Installation and operating instructions for the 24V dc selectable analog 4 output module.
1794-OW8 Installation Instructions	1794-5.19	Installation and operating instructions for the 24V dc, 48V dc, 120V ac, and 240V ac 8 relay sink/source output module.
1794-IR8 User Manual Installation Instructions	1794-6.5.4 1794-5.22	Installation and operating instructions for the 24V dc 8 input RTD module.
1794-IT8 User Manual Installation Instructions	1794-6.5.7 1794-5.21	Installation and operating instructions for the 24V dc 8 input thermocouple mV module.
1794-TB3 Installation Instructions	1794-5.2	Installation instructions for the 3-wire terminal base.
1794-TB3S Installation Instructions	1794-5.42	Installation Instructions for the FLEX Ex spring clamp terminal.
1797-TB3S Installation Instructions	1797-5.2	Installation instructions for the 3-tier screw clamp terminal base unit.
1794-TB3T Installation Instructions	1794-5.41	Installation instructions for the screw clamp temperature terminal base.
1794-TBN Installation Instructions	1794-5.16	Installation Instructions for the terminal base unit.
1794-TBNF Installation Instructions	1794-5.17	Installation instructions for the fused terminal base.

Table 1.I Related User Documentation

Document	Pub Number	Description
1797-series I/O		
1797-IBN16 Installation Instructions	1797-5.7	Installation Instructions for the .5V dc non-isolated NAMUR input module.
1797-OB4D Installation Instructions	1797-5.6	Installation Instructions for the 24V dc non-isolated source output module.
1797-IE8 User Manual Installation Instructions	1797-6.5.1 1797-5.5	Installation and operating instructions for the 8 pt. 16 bit single-ended non-isolated input module.
1797-OE8 User Manual Installation Instructions	1797-6.5.1 1797-5.3	Installation and operating instructions for the 8 pt. 13 bit single-ended non-isolated output module.
1797-IRT8 Installation Instructions	1797-5.4	Installation instructions for the 8 pt. 16 bit non-isolated RTD Thermocouple/mV input module.
PLC-5 Documentation		
User Manual	1785-6.5.12	Operating instructions for Enhanced and Ethernet/IP PLC-5 Programmable Controllers.
User Manual	1785-6.5.22	Operating instructions for ControlNet PLC-5 Programmable Controllers.

Performance and Capacity Specifications

ATTENTION

This chapter contains the most the current platform requirements from the performance and capacity specifications for R320.0.

PC/NT Platform Requirements

The performance of the NT Platform varies greatly based on the system configuration. All information should be considered before ordering or configuring a system. Customers who are upgrading should consider upgrades to match the specifications outlined in this document.

Server Requirements

ProcessLogix Server Software must be installed on a PC that is specifically qualified. Use of any other PC variations will render the standard warranty and support agreement null and void.

IMPORTANT

End users purchasing ProcessLogix 1757-PLXSYSKIT are not eligible for the standard 90 day technical support, unless the software is installed by personnel trained specifically for ProcessLogix installation.

Please refer to the table below to review the hardware requirements for a new R320.0 ProcessLogix server or client system. ProcessLogix Clients require a Windows NT operating system to support the multiple-user configuration nodes architecture that is possible with R320.0 ProcessLogix systems.

Table 2.A Server Requirements

Base	Dell OptiPlex GX200
Processor	800Mhz,Pentium III, 133Mhz Front Side Bus
Integrated Functions	4X AGP Video w/8MB of Memory, Audio, 512KB Cache 10/100 NIC
Mouse	MicroSoft Intellimouse
Keyboard	Quietkey Spacesaver 104-Key, US
System RAM	256MB, ECC PC700, 1 RIMM
CD-ROM	40X SCSI
Floppy Drive	1.44MB, 3.5"
SCSI Controller	Adaptec 29160N Controller
Hard Drive	9.1GB Minimum U2W, 10,000 RPM, SCSI
Tape Drive	10/20 G, SCSI, TR-5, Tape Backup Unit
Network	NIC, 3COM 3C905C Integrated Network Adapter Card, RJ45
I/O Expansion	3 PCI, 2 shared, 2 ISA
Software	MicroSoft NT4.0 (Service Pack 6a), NTFS All hardware component drivers

Platform System Configuration Definitions

Small System

A small configuration may consist of 1 non-redundant Server with 1 Station or a redundant server pair. The system typically includes only passive monitoring and occasional report generation.

Medium System

A medium configuration may consist on 1 non-redundant Server and multiple Stations or a Redundant Server pair with no more than 2 additional Stations. This type of system includes 1 or 2 Stations actively monitoring and occasional report generation.

Large System (Windows NT workstation as the operating system)

A large configuration may consist of a non-redundant Server and up to 10 station, or a redundant Server pair and up to 8 Stations per redundant Server pair. These systems typically include active monitoring from multiple Stations with or without multiple locations and random report generation.

Large System (Windows NT Server as the operating system)

A large configuration may consist of a Redundant Server pair and up to 20 stations. These systems typically include active monitoring from multiple Stations with or without multiple locations and random report generation.

Database Size in relation to System Configurations

The number of physical Servers and Stations does not alone determine system configuration. If a large and complex process is being considered, this will affect the size of the database. For example, a configuration may require passive monitoring and occasional report generation, but the process is large and complex. Therefore, it would be better to install a system which better matches the medium system rather than the small system. Use the table below to approximate your database size in relation to your system size. (It may require you to upgrade to a larger system.

Table 2.B Database Sizing Chart

Configuration Examples	Database Size	System Suggestion
1 Hybrid Controller * Process systems with up to 100 CM/SCM/IOM	0-200 MB	Small
2-3 Hybrid Controllers * Process systems with up to 500 CM/SCM/IOM	200-350 MB	Medium
3-6 Hybrid Controllers * Process systems with 500-600 CM/SCM/IOM	350-500 MB	Large Workstation
5 or more Hybrid Controllers * Process systems with more than 600 CM/SCM/IOM	Greater than 500 MB	Large Server
* Hybrid Controllers configured in a redundant mode should be counted as 1 Hybrid Controller.		

The following tables show the minimum, typical and high performance platform requirements. Please note that when you order a ProcessLogix system, you recieve the large server (shaded).

Table 2.C Minimum Platform Requirements

Minimum **Platform Requirements based on System Configurations**						
	Server			**Station**		
System Configuration	Small	Medium	Large	Small	Medium	Large
Processor	266-400 MHz Pentium II	550 MHz Pentium III	800 MHz Pentium III or Larger	200 MHz Pentium Pro	300 – 400 MHz Pentium II	550 MHz Pentium III or Larger
RAM						
• Win 95/98	--	--	--	64 MB	64 MB	96 MB
• Win NT 4.0 Workstation	96 MB Note 1	128 MB Note 1	160 MB	64 MB	64 MB	96 MB
• Win NT 4.0 Server	128 MB Note 1	192 MB Note 1	256 MB	--	--	--
Video Resolution Note 2	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors
Hard Drive	2 GB	4.3 GB	9.1 GB	2 GB	4.3 GB	4.3 GB

Table 2.D Typical Platform Requirements

Typical **Platform Requirements based on System Configurations**						
	Server			**Station**		
System Configuration	Small	Medium	Large	Small	Medium	Large
Processor	266 - 400 MHz Pentium II	550 MHz Pentium III	800 MHz Pentium III or greater Note 10	200 MHz Pentium Pro	300 – 400 MHz Pentium II	550 MHz Pentium III or greater
RAM						
• Win 95/98	--	--	--	64 MB	64 MB	96 MB
• Win NT 4.0 Workstation	160 MB	192 MB	224 MB	80 MB	80 MB	112 MB
• Win NT 4.0 Server	160 MB	224 MB	288 MB	--	--	--
Video Resolution Note 2	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors
Hard Drive	4.3 GB	4.3 GB	9.1 GB	2 GB	4.3 GB	4.3 GB

Table 2.E High Performance Platform Requirements

High Performance Platform Requirements based on System Configurations						
	Server			**Station**		
System Configuration	Small	Medium	Large	Small	Medium	Large
Processor	300-400 MHz Pentium II	550 MHz Pentium III	800 MHz Pentium III or Larger Note 10	266 MHz Pentium II	300 – 400 MHz Pentium II	550 MHz Pentium III or Larger
RAM						
• Win 95/98	--	--	--	64 MB	64 MB	96 MB
• Win NT 4.0 Workstation	160 MB	224 MB	256 MB	96 MB	96 MB	128 MB
• Win NT 4.0 Server	192 MB	224 MB	320 MB	--	--	--
Video Resolution Note 2	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors	1024 x 768 65K colors
Hard Drive	4.3 GB	4.3 GB	9.1 GB	4.3 GB	4.3 GB	4.3 GB

Server configuration memory allocations assume Server services only. Station Client memory usage already includes the ProcessLogix Client Applications. However, most applications can be run on either the Servers or Station Clients. On small to medium systems, these applications may be run on the Server Platforms. On large systems, the Servers should be dedicated to running only the Server Services. On these systems, when possible, all applications should be run from the Client stations.

Using the Platform Requirement's Table as a base for memory usage, add on the memory requirements for each of the applications from the table below intended to be used on a regular basis. (See Note 3.)

WARNING

Failure to add additional memory may result in degradation of system performance.

Table 2.F Application RAM Usage

Application	RAM Usage
NT 4.0 Applications	
Explorer	4 MB
User Manager (Note 4)	2 MB
Disk Administrator (Note 4)	2 MB
Event Viewer	2 MB
Task Manager (Note 4)	2 MB
Internet Explorer	6 MB
NT Backup	3 MB
ProcessLogix Applications	
Station (Note 5)	5 MB
Control Builder	13 MB
Network Tools application (Note 4)	3 MB
Quick Builder (Note 4)	10 MB
DB Admin (Note 4)	10 MB
Import Export Tool (Note 4)	7 MB
Knowledge Builder	Adds 2 MB on top of Internet Explorer
FieldBus: NIFB (Note 8)	8 MB
FieldBus: NI FBUS Configurator (Note 9)	13 MB
Other Applications	
RSBatch (Note 6)	128 MB
Microsoft Excel	7 MB
Microsoft Excel with Data Exchange	10 MB
Microsoft Word	13 MB
Upgrading Options	
Non-Redundant to Redundant ProcessLogix	32 MB (Note 7)

Notes:

1. In these configurations, paging may occur on these systems. Based on the intended usage of the platform, this configuration is acceptable. For better performance, users should upgrade the systems with an additional 64 MB of RAM.
2. The Video Memory required to support this resolution varies by video module type, PC bus supported, and manufacturers spec. Please refer to Video Card Specifications for details. All systems should be set 1024 x 768 with 65K colors. Mhz setting should be set to match the monitor.
3. Application usage on Servers greatly effects the CPU resources. A CPU upgrade or platform upgrade should be considered if your primary usage of the applications will

be on the Servers. On Redundant Systems, primary application usage should be on the Backup Server.

4. These applications are more for configuration and typically are not run all the time. They represent a one-time memory allocation when running. When considering additional RAM requirements, you should only include those applications in which you intend to run on a daily or constant basis.
5. The Station application affects the Station and Server Node. The memory should be added on both physical boxes per application. For example, if the Server is going to support 5 Stations, then you would require an additional 25 MB (5 x 5).
6. RSBatch includes multiple NT services and applications.
7. These upgrade requirements are per Server Node.
8. If NIFB is run on the Primary ProcessLogix Server or the Server is Non-Redundant, then that server is limited to only 8 CN2FFs.
9. While using the NI FBUS Configurator, you can only monitor 1 CN2FF at one time. This application should only be run on the Backup Server (if redundant) because it will put an additional CPU load on the system approximately 35% higher than your normal running state. If run on a Non-Redundant Server, you must have a higher performance CPU configuration.
10. It is possible to exceed the single CPU processing power in some larger configurations. Due to the larger configuration, please consider following the RAM guidelines for an NT Server platform. Dual CPU systems are not supported. The MS Access Jet Database engine used in R320.0 does not adequately support dual CPU systems.

ATTENTION

Low memory and CPU resources can affect Server performance in the following ways:

- Low memory can impact CB and Station operations such as display call-up and screen refresh. Background applications such as RSLinx and CDA can also be impacted. On occasion, extremely low memory resources have caused foreground and background applications to fail.
- Low memory causes virtual memory to be swapped often, which itself is a CPU intensive operation. Therefore, low memory directly affects the amount of available CPU resources.
- Low CPU resources can impact communication between Clients and Server. Although the communication subsystem guarantees data delivery, low CPU resources can create communication bottlenecks that adversely affect the freshness of data displayed.
- Low CPU resources can impact CB operations such as: opening charts, loading, uploading and updating project.

ATTENTION

Users of large systems should consider upgrading to higher performing server based platforms than noted here.

When making your selection, make sure it is Certified for NT Server or Windows 2000 Server use.

Systems, which use NT Server, can benefit from some performance tweaks made to the operating system. These changes affect application usage on the Server node and thereby should only be made when system is dedicated for Server use. All application usage should occur on clients.

Navigate in Knowledge Builder to *Network Planning Guide⇒Plant Information Network* for more information.

User Interface Capacity and Performance

Table 2.G Operational display update rates

Maximum Continuous Display Update Rate	1 sec
Typical Field Change to Display Update Time with 100 Parameters Per Display on a Single Station/Server (Server configured for 1 sec update)	< 2 sec
Typical Display Call Up Time with 100 Parameters on a Single Station/Server (Call up time is dependent on display complexity; this excludes the first initial call up.)	< 2 sec
Maximum Number of Concurrent Users Connected to one Server. See Table 2.M on page 2-12 for information that may affect the number of Stations that may be connected simultaneously.	20

Table 2.H Multi-user CB operational limits

Maximum CB Clients connected to single Server	4
Remote Access Service (RAS) support for Multi-User CB	Not Supported
Dial-up Networking support for Multi-User CB	Not Supported
Minimum continuously available Network Bandwidth required for each multi-user CB Client.	128KB

ATTENTION

Viewing the expanded Monitoring Tab Tree View of the same 1757-PLX52 Controller loaded with more than 500 total CMs, SCMs and IOMs from more than one CB client simultaneously, will **severely** affect the performance of the 1757-PLX52 Controller's communication capability, both to the Server and Peer-to-Peer.

Using multiple CB clients to load to multiple controllers simultaneously actually increases the overall load time. Do not employ this technique as a way to save time in loading a controller with contents.

Database operations (load, delete, upload, update, etc.) initiated from a CB client will affect the performance of applications that run on the backup Server. Remote CB clients will also be affected by these operations. For instance, a CB client will experience reduced performance if another CB client is also connected to the same Server and has requested a large database operation.

Control Network

Table 2.I Process Control Network Specifications

Supervisory Process Control Network		
Network Media	Ethernet	ControlNet
Supervisory Networks per ProcessLogix Server - 1 1784-PCIC Card per NT Mixed Supervisory ControlNet & Ethernet on the same Server is not supported.	1 non-redundant network serviced by 1 redundant or non-redundant Server	1 redundant or non-redundant network serviced by 1 redundant or non-redundant Server
Allowable Combinations of Controllers * per Server	Up to 10 Non-Redundant only	Up to 10 Redundant or Non-Redundant in any combination
Data Rate	10 Mbits/sec	5 Mbit/sec
Media Redundancy	Non-redundant only	Single cable or redundant media operation supported.
*Controller Definitions including PLCs Multiple 1757-PLX52s per chassis are NOT supported. However, a non-redundant 1757-PLX52 can reside in the same chassis as a Logix 5550.	Non-Redundant: • 1 1757-PLX52 • 1 Logix5550 • 1 PLC5/C or E • 1 SLC (Ethernet only)	Redundant: • 2 1757-PLX52s in a Chassis Pair with 2 1757-SRMs

Server Redundancy

Table 2.J Server redundancy specifications

Server Switchover Time – Default	30-40 sec
Server Switchover Time – Fastest Configurable Time	10 sec
On Server switchover, the 1757-PLX52 performs an event recovery. This causes the controller to report all current alarm conditions. The Server will report all current process alarms and events.	
Database synchronization is performed as a background activity and is performed online without affecting the operation of the Servers. Time to perform synchronization will depend on the system configuration (e.g., database size, history, processor speed).	

Server Notifications

Table 2.K Server notification specifications

Maximum number of events (burst condition)	500 events
Maximum number of events/second (sustained)	40/sec
Maximum number of alarms/second (sustained)	20/sec
Note: Up to two events are also generated for every alarm, including one event for entering the alarm condition and one for return to normal.	

Communications Capacity and Performance

Controller Communications

Table 2.L 1757-PLX52 Controller Communications Performance

1757-PLX52 Controller Communications Performance		
PPS = Average Parameters per Second		
Overall Communications Performance per ProcessLogix Server	**50 ms CEE**	**5 ms CEE**
Maximum Total Parameter Access Response Rate to the Server from all Controllers combined (Includes Display updates, Fast/Slow History, Excel I/ODBC Exchange, and CB Monitoring)	4000 PPS	4000 PPS
Overall Communications Performance per 1757-PLX52	**50 ms CEE**	**5 ms CEE**
Maximum Total Parameter Access Response Rate (Includes all Server Data Requests and peer communications)	2000 PPS	2000 PPS
1757-PLX52 to 1757-PLX52 Communications Performance per 1757-PLX52	**50 ms**	**5 ms**
Because Ethernet is inherently a non-deterministic network, no guarantees can be made about the timely delivery of critical data packets. The support of TCP/IP Ethernet as the Supervisory network in ProcessLogix does not preclude the customer to design and configure a mission critical control strategy based upon Ethernet. • Ethernet is not a deterministic network, consider these factors before employing a mission critical control strategy: Ethernet is subject to collisions, deferred transmissions, and other anomalies, which may delay the arrival of critical data packets • Internal testing has shown that under a full load condition, approximately 1 in 30,000 peer fetches arrive at a peer node at greater than twice the configured peer update rate.		
Maximum Initiator Node Pull/Get Request Rate to all target nodes (Based on the number of requests for peer data and the peer update rate.)	500 PPS	500 PPS
Maximum Initiator Node Pull/Get Request Rate to all target nodes (ControlNet)	50 @ 100 ms 100 @ 200 ms 250 @ 500 ms 500 @ 1 sec	5 @ 10 ms 10 @ 20 ms 25 @ 50 ms 50 @ 100 ms 100 @ 200 ms 250 @ 500 ms 500 @ 1 sec
Maximum Initiator Node Pull/Get Request Rate to all target nodes (Ethernet)	250 @ 500 ms 500 @ 1 sec	250 @ 500 ms 500 @ 1 sec
Maximum Target Node Response Rate to Pull/Get Requests from all initiator nodes	500 PPS	500 PPS
Maximum Initiator Node Push/Store Request Rate to all target nodes*	50 PPS	50 PPS

Table 2.L 1757-PLX52 Controller Communications Performance

Maximum Target Node Response Rate to Push/Store Requests from all initiator node: • For Ethernet Supervisory LAN systems, the maximum store rate is 500 msec.	50 PPS	50 PPS
*Currently the SCM Step is the only block type that can initiate peer push/store requests for peer communications.		
1757-PLX52 to PLC – Peer-to-Peer Communications Capacity per 1757-PLX52	**50 ms CEE**	**5 ms CEE**
Maximum Number of *Exchange* REQUEST blocks per 1757-PLX52	32	32
Maximum Number of *Exchange* RESPONSE blocks per 1757-PLX52	32	32
Maximum Number of "active" Target Devices for REQUEST blocks per 1757-PLX52 • 1 DHRIO Module only counts as 1 Target Device even when communicating with multiple PLCs on either DH+ network	8	8
Maximum Number of DHRIO Modules per 1757-PLX52	2	2 (local chassis only)

Client/Server Communication Capacity

Table 2.M Server communication NetBIOS session usage

Session type or activity	Comment/example
Time Sync	Active once every configured Time Sync period.
Shared Drives/ Displays	Active continuously, if Station Client get displays from central Server.
Shared printer	Active continuously if linked to a network printer for Reports, etc.
Server Redundancy	Uses from 1-3 Server Sessions based upon User/Login Configuration settings. (Also requires Time-Sync)
ER Server	Active during ER Sync on Redundant Server if configured for ER Server account.
Multi-User CB	Active during Point Build (uses shared drive)
Snap-Shot Save & Restore	Active during this operation (uses shared drive)

Table 2.N Server communication NetBIOS session capacity

Server Type	Simultaneous NetBIOS sessions available
ProcessLogix Server on NT Workstation	10
ProcessLogix Server on NT Server	Unlimited (See Microsoft license restrictions)

Controller Notifications

Table 2.O Controller Notifications Performance

1757-PLX52 Controller Notifications Performance (50 ms and 5 ms CEE)	
Maximum number of events (burst condition)	50 events
Maximum number of event/second (sustained)	2/sec
• Up to a minute between event bursts	

Controller Redundancy

ATTENTION

The Ethernet Module cannot be used with Controller Redundancy

Table 2.P Controller Redundancy (50 ms CEE only) Specifications

Controller Redundancy (50 ms CEE only)	
Controller models supported	1757-PLX52 only
Control Processing Switchover Interruption Time	500 ms
Redundancy Module Cable Medium	Fiber Optic Cable
Redundancy Module Cable Lengths	1, 3, 10 meters
Redundancy Module Slot Width	2 slots
Initial Synchronization Timer (from Sync Start to Completion)	90 sec
Maximum Elapsed Time Between Commanded Switchover and Completion of Initial Synchronization	120 sec
Maximum Elapsed Time Between Switchover Due to Power Cycle of the Primary and Completion of Initial Synchronization	150 sec

I/O Specifications

Table 2.Q I/O Module Capacity

I/O Module and Fieldbus Capacity	50 ms CEE	5 ms CEE
Maximum Number of IOMs per 1757-PLX52 (1756/1757 + 1797 FLEX EX + 1794-FLEX I/O + CN2FFs in any combination, exceptions noted below.)	64	12 (local 1757/1756 I/O only)
Maximum Number of Analog IOMs per 1757-PLX52 (including Pulse Input Modules)	64	12 (local 1757/1756 I/O only)
Maximum Number of Serial Interface Modules per 1757-PLX52	3	1
Maximum Number of FTA assemblies per Serial Interface Module • Each FTA connected counts as 4 IOMs in the 64 Max IOM calculation above and the 24 IOMs/1756-CNB calculation below.	2	2
Maximum Number of Remote I/O Chassis + 1794/1797-ACNR15s (combined) per 1757-PLX52.	8	0 (local 1757/1756 I/O only)
Maximum Number of IOMs per Downlink 1756-CNB - 1756/1757 + 1797 FLEX Ex and 1794 FLEX I/O + CN2FFs in any combination (with TC-MUX021, 1757-PIM and CN2FF limitations as noted elsewhere) • Each Pulse Input Module counts as 1.5 IOMs in the 24 IOM/1756-CNB calculation (but not the 64 IOM/1757-PLX52 limit).	64 scheduled 24 unscheduled	0 (local 1757/1756 I/O only)
Maximum number of Downlink 1756-CNB's per Controller Chassis	4	0
Maximum number CN2FFs per 1757-PLX52 • Each Linking Device counts as 1 IOM in the 64 IOM/1757-PLX52 calculation above.	8	0 (local 1757/1756 I/O only)
Maximum number CN2FFs per Non-Redundant Server	8	0 (local 1757/1756 I/O only)
Maximum number CN2FFs per Redundant Server (NI-FBUS Service and NI Configurator must be run on the Backup Server only)	16	0 (local 1757/1756 I/O only)
Maximum number CN2FFs per NI Configurator Project	1	0 (local 1757/1756 I/O only)
Maximum Number of H1 segments per CN2FF	2	N/A
Maximum number of CN2FF Devices per H1 segment connected to a CN2FF.	10	N/A

ATTENTION

Avoid operator-induced redundant controller switchovers with I/O that is configured but not physically present. In a redundant controller, the new primary 1757-PLX52 infrequently may become mute or hard fault under stress test conditions involving both {1} a non-trivial number of repetitive switchovers and {2} I/O configured in the controller that is not physically present. The only recovery is to power-cycle the mute of faulted primary controller.

Input Module Sample Periods

Table 2.R Input Module Sampling Period Specifications

Module types	Sampling period
Typical Input Module Includes 1757/1756 input modules 1797-FLEX Ex and 1794-FLEX I/O input modules, and CN2FFs with exceptions noted below	25 ms
High Density / Non-Isolated Analog Input Module (1756-IF16)	250 ms
RTD Module (1756-IR6I)	50 ms
Thermocouple Module (1756-IT6I)	50 ms
TC-MUX021	250 ms
Digital Input Module used by 5 ms (local only)	1 ms
Note: For CMs which contain associated input channels, it is recommended that the CM execution period should be set to at least double the input module sampling period.	

Output Module Sample Periods

Table 2.S Output Module Sampling Period Specifications

Output Module Sampling Period Specifications	
Module Type	**Sampling Period**
Typical Output Module 1757/1756 +1797 FLEX EX and 1794-FLEX I/O Output Modules	50 ms

I/O Network Configuration Rules

Table 2.T I/O ControlNet Addressing

I/O ControlNet Addressing	
MACID	**Rules and Descriptions**
1 (ControlNet Keeper)	1) Must be configured on every physical I/O ControlNet segment. 2) Must be assigned to the Downlink 1756-CNB in the Controller chassis or to both Primary and Secondary Downlink CNBs in a Redundant Chassis Pair (RCP) for each physically separate I/O ControlNet segment.
2	1) Must not be assigned to any Node when using Redundant Controller. 2) Should be reserved when using non-redundant Controller for future Redundant upgrade.
3	1) Must not be assigned to a Downlink 1756-CNB in a Controller chassis or Redundant Chassis Pair. 2) Must be assigned to a Remote 1757/1756 I/O chassis 1756-CNB or Remote 1794/1797-ACNR15 or CN2FF, in conjunction with each MACID #1 assignment.
4	Should be used by or reserved for additional Remote 1757/1756 I/O chassis 1756-CNB or 1794/1797-ACNR15 or CN2FF.
5 and up	Should be used consecutively from low to high values with the following guidelines: • Odd addresses should be used for additional Downlink CNBs in Controller chassis or RCP (with next even address not used), when additional Downlink CNBs are connected to a common physical I/O ControlNet segment (not allowed with CN2FFs connected). • After Downlink CNBs are assigned, remaining addresses may be used for additional Remote 1757/1756 I/O chassis CNBs or 1794/1797-ACNR15s or CN2FFs.

Additional I/O ControlNet Rules

- Multiple I/O ControlNet Downlink CNBs may be connected to a common physical I/O ControlNet segment and must adhere to the rules above. **Exception** for this rule when using CN2FFs, which must use separate physical segments.
- PLCs or other ControlNet Devices may not reside on any I/O ControlNet segment connected to a BETA-PLX52 or 1757-PLX52 Controller.
- The ControlNet Keeper is the lowest configured MAC ID per physical ControlNet segment. This table assumes that MAC ID #1 exists per ControlNet segment.
- When the CN2FF is being used, the ControlNet Parameters for that segment must be configured for NUT = 6.25 ms. and SMAX = to the Highest MACID used (but < = UMAX), using Network Tools.

1757-PLX52 Resources

Table 2.U 1757-PLX52 Configuration Options

1757-PLX52 Configuration Options		
1757-PLX52 Module Slot Width	2 slots	
Base Execution Periods Supported (different personalities required)	50 ms, 5 ms* Note: 5 ms CEE not supported on BETA-PLX52	
	50 ms CEE	5 ms CEE
Controller Redundancy Supported	Yes	No
Remote I/O Supported	Yes	No
I/O Module Execution Period	50 ms	5 ms
Configurable Values for CM/SCM Execution Periods	50, 100, 200, 500, 1000, 2000 ms	5, 10, 20, 50, 100, 200 ms
Configurable Values of Peer Update Rates (period). • Defines the period at which data is updated for all 'pull/get' requests for peer data required by all blocks within a CEE. *Supervisory Ethernet LAN systems only guarantee a Pull/Get Request Rate of 500 msec or greater. Faster Pull/Get rates can be configured, however, data arrival at the configured rate cannot be guaranteed for rates faster than 500 msec.	100, 200, 500*, 1000* ms	10, 20, 50, 100, 200, 500*, 1000* ms

Table 2.V 1757-PLX52 Processing Resources

1757-PLX52 Processing Resources		
Definitions: PU = Processing Unit. The PU represents a platform independent of the number of processing resources (time) required to complete a predefined amount of computational (control) work. Maximum Cycle Loading: Over an cycle (0-39), the "Average CPU Used" (CPUCYCLEAVG) statistic is not to exceed the stated maximums.		
Minimum Reserved CPU to be Maintained During Runtime (CPUFREEAVG)	20%	
1757-PLX52 Configuration	**PU Maximum**	**Maximum Cycle Loading**
50 ms CEE – Non-Redundant Configuration	3600 PU/sec	60%
50 ms CEE – Redundant Configuration	1600 PU/sec	60%
5 ms CEE – (Non-Redundant only)	2400 PU/sec	40%

Table 2.W 1757-PLX52 Memory Resources and Block Configuration

1757-PLX52 Memory Resources and Block Configuration	
Definition: MU = Memory Unit = 1 Kbyte = 1024 bytes	
Maximum Available 1757-PLX52 Memory Resources	4000 MU
Maximum Total Number of CMs, SCMs and IOMs Configurable per 1757-PLX52	1000
Maximum Number of Component Blocks per CM	40
Maximum Total Number of Steps and Transitions (in all handlers) per SCM	160 (80 Step/Transition pairs)

Table 2.X Typical IOM/CM/SCM Processing and Memory Resource Requirements

Typical IOM/CM/SCM Processing and Memory Resource Requirements			
Total Processing Resources (PU/sec) per module are computed as = Processing Resource Consumption (PU/module execution) / Execution Period (sec/module execution).			
Typical Module Types (FB Content in Parenthesis)	**Processing Resource Consumption (Per Module)**		**Memory Resource Usage See Notes**
	50/5 ms CEE Non-Redundant (PU/Module Execution)	50 ms CEE Redundant (PU/Module Execution)	50/5 ms CEE (MU/Mod)
Typical I/O Module (Average consumption of available IOMs)	0.3	0.19	0.6
Analog Digital Acquisition Module (10 AI, 10 DataAcq FBs)	2.9	3.8	7.4
Small Analog Data Acquisition Module (1 AI, 1 DataAcq FB)	0.47	0.43	1.0
Regulatory Control Module (1 AI, 1 DataAcq, 1 PID, 1 AO, 6 Logic FBs)	2.8	2.8	3.9
Auxiliary Function Module (10 Aux. FBs, such as AuxCalc, Totalizer)	4.2	5.1	13.1
Digital Data Acquisition Module (10 DI, 10 Flag FBs)	1.2	1.2	3.1
Small Digital Data Acquisition Module (1 DI, 1 Flag FBs)	0.22	0.14	0.6
Device Control Module (2 DI, 2 DO, 1 DevCtl, 5 Logic FBs)	1.3	1.3	3.1
Logic Control Module (20 Logic FBs)	1.0	1.0	3.5
Sequence Control Module(1)	2.0	3.0	55

Table 2.X Typical IOM/CM/SCM Processing and Memory Resource Requirements

Sequence Control Module with an alias table of size 45 rows by 100 columns[2]	2.0	3.0	150
Sequence Control Module with an alias table of size 500 rows by 9 columns[3]	2.0	3.0	146

NOTES:
These Block Libraries will consume the following extra memory when the first block is loaded to the 1757-PLX52 Controller:
EXCHANGE – 70 MUs
1757-PIM – 100 MUs
1797-FLEX EX + 1794- FLEX I/O – 125 MUs
FBUSIF – 90 MUs

[1] 1 each of Main, Hold, Stop and Abort Handlers, 10 Steps with 8 Outputs each, 10 Transitions with 5 Conditions each interspersed in all handles, 10 Recipe items, 5 History items

[2] 1 each of Main, Hold, Stop and Abort Handlers, 10 Steps with 8 Outputs each, 10 Transitions with 5 Conditions each interspersed in all handles, 10 Recipe items, 5 History items

[3] 1 each of Main, Hold, Stop and Abort Handlers, 10 Steps with 8 Outputs each, 10 Transitions with 5 Conditions each interspersed in all handles, 10 Recipe items, 5 History items

Engineering Tools Resources

Table 2.Y Engineering Repository Configuration

Engineering Repository (ER) Database Configuration	
Recommended Maximum Size of ER Database (Compacted)	1 Gbyte

WARNING

Large database operations (load controller, delete controller, upload controller, update controller, etc.) on a 1757-PLX52 loaded with more than 500 total CMs, SCMs and IOMs will fragment the ER database. This can cause a growth in the ER database of 2-3 times over the initial size of the database. After large database operations, the database **must** be compacted to avoid potential performance and database corruption problems. Use the DBAdmin Tool to compact the database.

WARNING

Import operations may cause a growth in the ER database size. After import operations, close the Control Builder and use the DBAdmin Tool to compact the database.

Major ProcessLogix R320.0 Software Components

Software Components and Revisions

This chapter contains the detailed information about the major ProcessLogix software components.

Major ProcessLogix FTW Software Revisions

Component	Version	Example Verification Mechanism
Control Builder	PS320.0-20.1	1. Execute Control Builder using Start⇒Programs⇒ProcessLogix Engineering Tools⇒Control Builder. 2. Click Help⇒About.
DBADMIN	PS320.0-20.1	1. Execute DBADMIN using Start⇒Programs⇒ProcessLogix Engineering Tools⇒DBADMIN. 2. Click Help⇒About.
IOTOOL	Release 320.0-20	1. Execute IOTOOL using Start⇒Programs⇒ProcessLogix Engineering Tools⇒IOTOOL. 2. Click Help⇒About.
Network Tools	PS320.0-20.1	1. Execute NTools using Start⇒Programs⇒ProcessLogix Engineering Tools⇒Ntools. 2. Click Help⇒About.
Engineering Tools Database	V4.0 ERDB Release 320.0-20.1	1. Run NT Explorer. 2. Double-click \Honeywell\TPS50\System\Bin\wixptool.exe 3. Click Help⇒About.
Knowledge Builder	Release 320.0-November 2000	1. Start⇒Programs⇒ProcessLogix Performance Support Tools⇒Knowledge Builder⇒Knowledge Builder. 2. Click Legal Notice link on the Welcome window.

Major ProcessLogix Server Software Revisions

Component	Version	Example Verification Mechanism
ProcessLogix Server	R320.0 (Build 300.4-4.12)	1. Execute ProcessLogix Server dialog box using Start⇒Programs⇒ProcessLogix Server⇒Start-Stop ProcessLogix Server. 2. Click System Menu (Top Left Corner) ⇒About.
Station	R320.2 (Build 011)	1. Execute Station using Start⇒Programs⇒ProcessLogix Server⇒Station. 2. Click Help⇒About.
Display Builder	Release 320.2 (Build 11) for R300 Server	1. Execute Display Builder using Start⇒Program⇒ProcessLogix Server⇒Display Builder. 2. Click Help⇒About.
Quick Builder	1.13 Build 228	1. Execute Quick Builder using Start⇒Programs⇒ProcessLogix Server⇒Quick Builder. 2. Click Help⇒About.
Microsoft Excel Data Exchange[1]	R300.5	1. Execute Excel using Start⇒Programs⇒Microsoft Excel. 2. Click Tools⇒Microsoft Excel Data Exchange⇒About Microsoft Excel Data Exchange.

(1) There is an incompatibility between Integrated Microsoft Excel Reports and the Windows NT Option Pack. The Windows NT Option Pack should not be installed on a ProcessLogix Server or Client.

Embedded Software Components

Component	Version	Example Verification Mechanism
Windows NT Service Pack 6A	6A 4.00.1381	1. At command prompt enter WINVER. 2. The response should include "Revised Service Pack 6a"
Windows 95 Service Release 2	4.00.950B	1. Right click My Computer. 2. Click Properties. 3. General Tab. **Limitations/Compatibilities:** • Station, Display Builder, and QuickBuilder only
Windows 98		1. Right click My Computer. 2. Click Properties. 3. General Tab. **Limitations/Compatibilities:** • Station, Display Builder, and QuickBuilder only
Internet Explorer 5.01	5.00.2919. 6307	1. Run Knowledge Builder (or Internet Explorer directly). 2. Click Help⇒About Internet Explorer. **Limitations/Compatibilities:** • no Active Desktop
MS Visual C++ Run-Time DLLs	6.00.8397.0	1. Run NT Explorer. 2. Right click \winnt\system32\MSVCRT.dll (Microsoft Run Time Library).
MS Visual Basic Run-Time DLLs	05.02.8244 Service Pack 2 6.00.8877	1. Run NT Explorer. 2. Right click \winnt\system32\msvbvm50.dll and \winnt\system32\msvbvm60.dll 3. Click Properties. 4. Version Tab.
Seagate Crystal Reports Run-Time DLLs	6.0.0.xx	1. Run NT Explorer. 2. Right click \winnt\crystal\p2b*.dll 3. Click Properties. 4. Version Tab.
Stingray Objective Grid	6.0.100	1. Run NT Explorer. 2. Right click \Honeywell\TPS50\System\Bin\objgrid.dll 3. Click Properties. 4. Version Tab.
Stingray Objective Toolkit	6.0.100	
RSLinx	2.20.01 Build 119	1. Execute RSLinx using Start⇒Programs⇒Rockwell Software ⇒RSLinx⇒RSLinx. 2. Click Help⇒About RSLinx.
Dtl32.dll	2.20.119.0	1. Run NT Explorer. 2. Right click \winnt\system32\dtl32.dll. 3. Click Properties. 4. Version Tab.

1784-PCIC Device Driver	1.0.20	1. Run NT Explorer. 2. Right click \winnt\system32\drivers\ABPCIC.sys. 3. Click Properties. 4. Version Tab.
1784-PCIC(S) Device Driver	3.0.5	1. Run NT Explorer. 2. Right click \winnt\system32\drivers\ABPCICS.sys. 3. Click Properties. 4. Version Tab.
MS-ODBC	3.510.4202.0	1. Run NT Explorer. 2. Right click \winnt\system32\odbc32.dll 3. Click Properties. 4. Version Tab.
MS-ODBC Desktop Driver Pack	4.0.4202.00	1. Run NT Explorer. 2. Right click \winnt\system32\odbcjt32.dll 3. Click Properties. 4. Version Tab.
MS-DAO	3.51.1608.0	1. Run NT Explorer. 2. Right click \winnt\System32\dao350.dll 3. Click Properties 4. Version Tab.
MS-JET	4.00.2927.2	1. Run NT Explorer. 2. Right click \winnt\system32\msjet40.dll 3. Click Properties. 4. Version Tab.
MS-Access	3.00.2504	1. Run NT Explorer. 2. Right click \Honeywell\TPS50\System\bin\mswng300.dll 3. Click Properties. 4. Version Tab.
Adobe Acrobat Reader	4.05B.0127	1. Run Adobe Acrobat. 2. Click Help⇒About.

External, Third Party Qualified Software Components

ATTENTION

This section identifies third party Windows-based software applications that are supported on a ProcessLogix Station Client. Special care must be exercised when using any of these third party packages.

WARNING

The user assumes all responsibility for issues resulting from the installation and operation of any components that have not been tested as compatible by Rockwell Automation. In addition, it is the customer's responsibility to ensure that the combinations of third party components have sufficient resources (e.g. memory, CPU performance, disk space, display space, etc.).

Component	Version	Example Verification Mechanism
McAfee NT SCAN Virus Scan	4.0.3a or 5.1	1. Execute VirusScan Console using Start\Programs\VirusScanNT\VirusScan Console 2. Click Help⇒About.
National Instruments NI-FBUS Communications Manager	2.3.5	1. Execute Fieldbus Interface Configuration using Start\Programs\National Instruments FBUS\Interface Config. 2. Click the System Menu. 3. Select about fbConfig_NT. **Limitations/Compatibilities:** • Model Number 1788-FFCT, for use with Model Number the CN2FF. Only this model number should be purchased and not the general release of the Configurator from NI.
MS Office 97 Products		**Limitations/Compatibilities:** • Excludes Outlook
Access	9.0.1381 Service Pack 1	1. Run NT Explorer. 2. Right click \Microsoft Office\Office\access.exe 3. Click Properties. 4. Version Tab. **Limitations/Compatibilities:** • Use on client only, Station
Excel	9.0.1381 Service Pack 1	1. Run NT Explorer. 2. Right click \Microsoft Office\Office\excel.exe. 3. Click Properties. 4. Version Tab.

Photo Editor	3.0	1. Execute application. 2. Click Help⇒About. **Limitations/Compatibilities:** • Use on client only, Station
PowerPoint	9.0.1381 Service Pack 1	1. Run NT Explorer. 2. Right click \Microsoft Office\Office\powerpoint.exe 3. Click Properties. 4. Version Tab. **Limitations/Compatibilities:** • Use on client only, Station
Word	9.0.1381 Service Pack 1	1. Run NT Explorer. 2. Right click \Microsoft Office\Office\winword.exe 3. Click Properties. 4. Version Tab. **Limitations/Compatibilities:** • Use on client only, Station
MS Visual C++	6.0 Service Pack 3	1. Run NT Explorer. 2. Right Click \winnt\system32\mscvrt.dll (Microsoft Run Time Library). 3. Click Properties. 4. Version Tab. **Limitations/Compatibilities:** • Use on client only, Station
MS Visual Basic	6.0	1. Run NT Explorer. 2. Right click \winnt\system32\msvbvm50.dll and \winnt\system32\msvbvm60.dll 3. Click Properties. 4. Version Tab. **Limitations/Compatibilities:** • Use on client only, Station
Carbon Copy 32[1]	5.5 or 5.10.244 Service Pack 3	1. Execute Carbon Copy 32 using Start\Programs\ProcessLogix Carbon Copy 32 \ Carbon Copy 32 2. Click Help⇒About. **Limitations/Compatibilities:** • Carbon Copy 32 cannot be installed in conjunction with other "remote control" software – e.g. PC Anywhere
VPLink	2.5.5	1.Execute VPLink 2.Click Help\About VP

(1) CarbonCopy32 use with Series 9000 Tools: CarbonCopy32 should not be used with the Series 9000 Tools for engineering purposes. Support for CarbonCopy32 is limited to use solely as a remote diagnosis/troubleshooting tool. It has not been qualified as a remote operator/engineering interface for ProcessLogix. It has been reported that it is not possible to remotely load a Data Table nor add any on-line ladder logic line/element to a running Series 9000 when CarbonCopy32 is used. This appears to be related to CarbonCopy32's special use of the Shift key.

Miscellaneous SCADA Component Revisions

Component	Version	Example Verification Mechanism
Modicon Netlib	2.1	1. Run NT Explorer. 2. Right click \winnt\system32\netlib.dll
RSLinx 2.2 OEM	2.20.01 Build 119	1. Double click RSLinx icon. 2. Click Help \ About RSLinx. 3. Verify version information.
RSNetworx	2.25.12	1. Double click RSNetworx icon. 2. Click Help \ About RSNetworx. 3. Verify version information.
RSLogix 5	4.10	1. Double click RSLogix icon. 2. Click Help \ About RSLogix. 3. Verify version information.
RSLogix 5000	6.01	1. Double click RSLogix icon. 2. Click Help \ About RSLogix. 3. Verify version information.
S9000 Configuration Tools[1]	200.3	
Siemens TF API for Industrial Ethernet	2.0	
RSBatch	2.1	

(1) CarbonCopy32 use with Series 9000 Tools: CarbonCopy32 should not be used with the Series 9000 Tools for engineering purposes. Support for CarbonCopy32 is limited to use solely as a remote diagnosis/troubleshooting tool. It has not been qualified as a remote operator/engineering interface for ProcessLogix. It has been reported that it is not possible to remotely load a Data Table nor add any on-line ladder logic line/element to a running Series 9000 when CarbonCopy32 is used. This appears to be related to CarbonCopy32's special use of the Shift key.

Process Simulation Software

Working as Rockwell Automation's Encompass partner, Cape Software delivers simulation solutions through VPLink®. Applications include the following:

- Control system verification and checkout

  Benefits of application:

  – checkout of graphics links
  – rigorous testing of logic
  – solution is non-evasive
  – testing is documented
  – many more sets of input conditions are presented than humanly possible

- Operator console training

  Benefits of application:

  – trainee works in front of actual console with real displays
  – trainee experiences startup and shutdown logic as well as normal operating conditions
  – trainee experiences upset and fault emergency responses

The Virtual Process (VP) Link simulation package connects to ProcessLogix in place of real I/O to provide you with comprehensive simulation facilities capable of returning realistic process values to the control system.

VPLink connects to ProcessLogix using a native interface developed by Cape. The package is supplied with 'extraction' facilities which read simulator I/O configuration data directly from the system database, and utilities to set the control software for simulation instead of real I/O and vice versa.

What's different about VPLink?

VPLink connects to the control network using the ProcessLogix API via TCP/IP local host connection. Alternatively, VPLink can execute on the Server, or on any other PC in the network.

VPLink can be used to simulate all real I/O connections. It bypasses the real I/O hardware, reducing costs during system checkout. The VPLink solution is high speed and exercises the control logic exactly as configured for plant operations. This guarantees that the logic exercised is exactly the software delivered to the field. Since no hardware wiring is required, the solution delivered by Cape Software is a low cost alternative to traditional hardware test panel implementation. Since no reconfiguration is needed and no control language programming is required, VPLink delivers a solution which is compatible with FDA, CMA, and OSHA recommendations for best practices. That is, the code tested is exactly the code implemented in the field.

VPLink creates simulation tags by using a lookup ASKII file to interrogate the ProcessLogix database and pull out all the I/O function block names via the ProcessLogix server API. VPlink switches the I/O function blocks between real I/O values and simulated values. Once the tags are brought into VPLink, they can then be configured to interact and provide the desired feedback by utilizing VP response modeling blocks.

Benefits of VPLink

Users of VPLink products have testified to many benefits for almost a decade. The following is an overview of these benefits.

Benefits for control system engineers and project managers:

- Dramatically shortens the Factory Acceptance Testing phase of the project.
- Lowers costs of Factory Acceptance Testing.
- Higher quality application software is delivered resulting in:
  - faster on-spec production, and
  - reduced time and costs supporting staff in the field.

Benefits for plant managers and operations supervisors:

- Operators are trained prior to startup on the actual system delivered to the field.
- Operators are trained on a process specific model.
- Operators are trained on the look and feel of the new interface.
- Upper management satisfies Process Safety Management Requirements for above.
- Emergency response training introduces process upsets and equipment malfunctions.
- Operator re-certification is achieved.
- Operator education is documented using quiz questions and answers.

VPLink's ProcessLogix Driver

With this driver, engineers do not need any real I/O cards, or any special hardware. They simply run Cape's utility software to align the VPLink configuration file.

Engineers are able to debug all of the following aspects of the control software:

- graphics connections
- control language programs
- PID controller action
- interlock logic

Higher level batch management software and/or advanced control solutions are tested and debugged as well.

VPLink System Requirements

- ProcessLogix system, including controller(s) with network interface connector and ProcessLogix Server
- PC with Ethernet card and WindowsNT
- VPLink for ProcessLogix

RSBatch™ Process Management for Batch Manufacturing

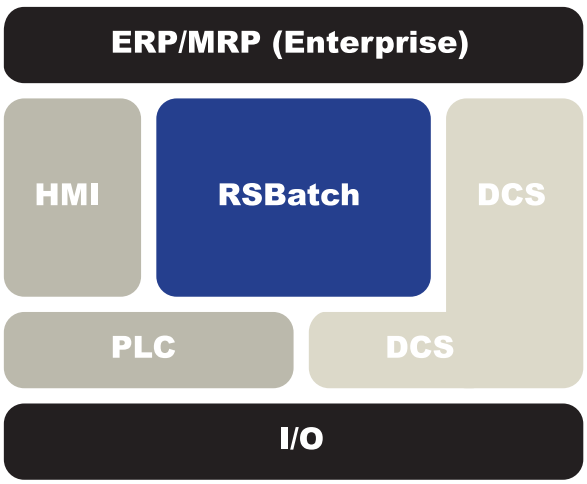
RSBatch is a process hardware-independent, object-oriented, modular batch automation solution. It can be used with your choice of process-connected devices; programmable logic controller/distributed control system. RSBatch is also software-independent and can integrate with a variety of HMIs, ERP/MRP systems, and other applications.

Whether performing simple unit-level operations or highly complex, network-structured, multi-product tasks, RSBatch provides the optimal solution. RSBatch allows you to:

- Create and manage recipes, execute recipes automatically
- Simulate your entire batch process
- Integrate with a wide variety of complementary software applications
- Write phases that can run in a PC environment
- Create and control batches using ActiveX® custom controls
- Control your process through any of today's most popular process-connected devices, including multiple types of PCDs (process-connected devices) within one application

EXAMPLE

For example, the heart of your process control system may be a ProcessLogix DCS with a ControlLogix Archiver controlling the raw material and final packaging. RSBatch can execute your recipes in the DCS system while requesting raw materials from material containers controlled by the controller.



- Collect detailed electronic batch record data about your process to generate detailed reports

- Integrate and exchange batch and recipe information with corporate information systems.

In recent years, the selection criteria for control systems has increasingly emphasized software functionality. From the sensor to the boardroom you need the best available software. You want all of your software solutions, including recipe management, process control, scheduling, reporting, ERP/MRP and others, to work together, providing the synergy that allows your business to prosper.

With RSBatch you should have the flexibility to select the best combination of PLCs and DCSs and other control hardware, and maintain a truly integrated solution. There is also the option of RSBatch for ProcessLogix ™. It integrates Rockwell Software batch expertise with the Allen-Bradley ProcessLogix distributed control system.

The option offers an efficient system development and a system approach to batch configuration. Designed specifically for the ProcessLogix platform, RSBatch for ProcessLogix features a ProcessLogix data interface that uses the function block and a sequential control module programming environment to simplify programming.

RSBatch uses the most current Microsoft ® ActiveX/OLE/DCOM technologies to ensure a powerful and flexible design. This approach enhances the functionality and robustness of the package, while providing seamless integration with a wide variety of hardware and software. This versatility lets RSBatch adapt to your facility's ever-changing environment. Its "plug and play" compatibility allows you to select the "best-of-breed" solution or integrate with "legacy" systems for your operation, ranging from simple spreadsheets to complex report generation, scheduling, ERP/MRP Systems, and Human-Machine Interface (HMI) software.

RSBatch integrates with the RA Integrated Logix Architecture that creates more flexibility in the process making it possible to use a single architecture across an entire application.

Systems based on the Integrated Logix Architecture function across multiple application segments because the components that make up the system have been designed to inter-face seamlessly, and use the same networking and I/O systems across the discrete and process areas of an application. RSBatch supports the use of the Universal Naming

Convention (UNC), which is implemented in networked environments to provide the full Windows NT ® shared resource path name. Specifically, UNC utilizes the name of the machine and the name of the shared resource, but it may also include directories and/or filenames.

Modular Batch Automation

RSBatch was developed around the principles of Modular Batch Automation as defined by the International Society for Measurement and Control (ISA) in its S88.01 standard. In Modular Batch Automation, a batch process is established by defining its physical and procedural aspects and their hierarchies. By defining the Physical and Procedural Models separately, greater flexibility and power are achieved. RSBatch also includes the benefits of the S88.01 standard:

- Modular control
- Flexible production capability
- Equipment-independent recipes
- Batch-independent coordination control
- Organized control methodology
- Company using same standard procedures
- Common terminology used by batch community.
- Increased process utilization and throughput
- Rapid product/process development and deployment
- Common control strategies and information flow
- Reduction of validating/commissioning hours

The Physical Model

The components of a process plant, though complex as a whole, can be easily categorized. They can be anything from a simple valve to an entire area of the processing plant. The Physical Model is simply the hierarchy in which every component is placed. Each level of the hierarchy is comprised of at least one of the components of the level just below.

Area a physical, geographical, or logical grouping made up of one or more process cells.

Process Cell – a complete collection of the equipment involved in the production of a batch, such as a complete polymer line. A process cell is made up of one or more units.

Unit — a collection of associated control and equipment modules that carry out at least one major processing activity, such as react or make a solution. A unit is made up of equipment and control modules.

Equipment Module – a group of equipment that carries out a specific, minor processing activity, such as mix or weigh.

Control Module – a regulating device, a state-oriented device, or a combination of the two that functions as a single device, such as a valve or pump.

The Procedural Model

A procedure is the portion of a recipe that contains the strategy for batch production. Each level of the Physical Model has a corresponding action in the Procedural Model.

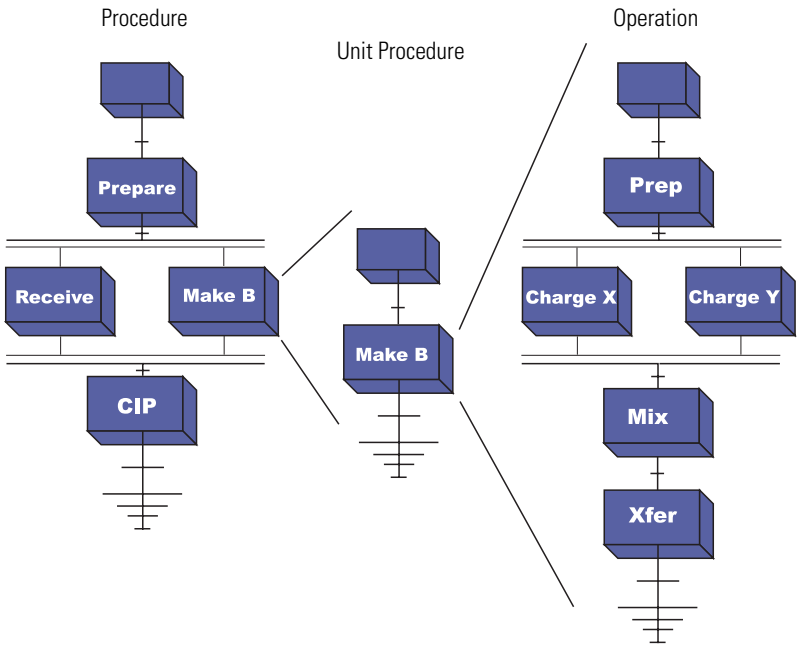
Procedure – the general strategy for batch production within a process cell. A procedure is made up of unit procedures.

Unit Procedure – a production sequence. Unit procedures are made up of operations.

Operation – the single algorithm necessary for the initiation, organization, and control of phases, such as filtration. Operations are made up of phases.

Phase – the lowest level of a procedure that can accomplish a single action, such as heat or dump.

Procedure Model



These features make RSBatch the ideal choice for enhancing the performance of batch manufacturing in any of the process industries including:

- Pharmaceuticals and Biotechnology,
- Food and Beverage,
- Fine Chemicals,
- Consumer Goods,
- Petrochemicals,
- Pulp and Paper, and
- Metal and Mining.

RSBatch Software Architecture

RSBatch provides the ability to configure the physical and procedural models, execute recipes through a variety of process-connected devices, and integrate control actions and production information with a diverse selection of complementary software. This functionality resides within the seven major components of RSBatch.

- Equipment Editor – graphically specifies the physical equipment using simple configuration selections.
- Recipe Editor – graphically specifies the procedural strategy using simple configuration selections.
- View – provides an operator interface to communicate with the RSBatch Server.
- Server – executes the recipes and coordinates communications between the RSBatch View, the process-connected device(s) and any other elements that make up your control system.
- Simulator – simulates and tests recipes against particular equipment specifications without a connection to the physical process.
- Archiver – transfers real-time electronic batch record data to any ODBC-compatible database. (ODBC stands for Open Database Connectivity, a widely implemented database connectivity standard created by Microsoft ®.)
- Report Editor – graphically creates and customizes detailed reports from the electronic batch record and other components of the control system.

The RSBatch Equipment Editor

The implementation of RSBatch begins with the configuration of the physical equipment using the S88.01 physical model and the RSBatch Equipment Editor. The Equipment Editor is a graphical tool for the creation and maintenance of process equipment. The items configured using the Equipment Editor include the following:

- Areas
- Unit Classes
- Unit Tags
- Process Cells
- Equipment Modules
- Shared Resources
- Process Cell Classes
- Equipment Module
- Classes
- Units
- Resource Classes

This information is available to all other RSBatch components. During recipe configuration, the Equipment Editor provides a list of available equipment functions, ensuring that the designated process is physically capable of executing the procedures. Once actual or simulated recipe execution begins, resource arbitration functions use this information to allocate equipment based on recipes and operator requests.

The RSBatch Recipe Editor

Recipes consist of descriptive information, formula information, equipment requirements, and the procedures used to make the batch. The RSBatch Recipe Editor provides a simple way to configure and organize all of this information. The editor allows you to graphically construct recipes using sequential function charts (SFCs), as defined by the IEC 1131-3 standard.

Once the equipment model is configured, the foundation is in place to build recipes. Recipes describe products and how those products are produced. There are four parts to a recipe:

Header – contains the name, revision, and other descriptive information.

Formula – includes ingredients, amounts, and parameter values.

Equipment requirements – defines specific equipment or equipment classes.

Procedure – defines the strategy, or sequence of phases, operations & unit procedures for making a batch.

Recipes contain parameters that control the behavior of the equipment phase logic. For example, an equipment phase may be able to control the temperature in a reactor, but the recipe values are needed to determine the proper setpoint. This relationship allows recipes to produce several products with the same equipment phase logic, without having to “hard-code” parameter values for each product.

A many-to-one relationship exists between recipe phases and equipment phases created in the Equipment Editor. This relationship is what allows class-based operations and unit procedures to be constructed. For example, a recipe procedure may require any “reactor” that can “heat” and “agitate” to be used. In one batch run, this may resolve to reactor 101, heat 101, and agitate 101. In another batch run, those could be reactor 256, temperature control, and stir.

Recipes can now be stored in a Relational Database (RDBMS) format and can be modified outside the Recipe Editor. Storing recipes in RDBMS format allows external applications to both update and report on data within the recipes through standard interfaces and languages such as Structured Query Language (SQL).This allows recipe definitions to be integrated with existing, legacy, and future business systems.

The RSBatch View

The RSBatch View is a powerful, easy-to-use graphical user interface (GUI) for controlling batches and the RSBatch server functions. The View includes security using the native Windows NT 4.0 User and User Group model. This allows RSBatch to take advantage of this proven security system.

In addition, many components of the View are packaged as ActiveX controls, allowing them to be placed in container applications, such as Web browsers or Visual Basic programs.

The standard interface features and functions of the RSBatch View include:

Batch List View – a list view of all current control recipes (batches) and their present states.

Procedure as SFC View – a graphical representation of a single control recipe.

Procedure as Table View – a spreadsheet view of a single control recipe.

Event Journal View – a real-time electronic batch record that provides detailed event data about a particular batch and allows queries to be made against the information.

Prompts – a list of all prompts in all control recipes which currently require operator input.

Phase Control – an interactive display that allows manual execution of individual recipe phases.

Arbitration – a view of current resource allocations. This can be manipulated by the operator.

Alarm Summary – a display of all failure/error messages sent to or generated by RSBatch for the current control recipes.

Phase Summary – a global view of all the equipment phases configured within the area model and their current states.

Configuration – a means of configuring the View windows to meet the operator's needs.

Help – the RSBatch online help system.

Human-Machine Interface – a configurable hot link to the Human-Machine Interface (HMI).

Login – opens the security login dialog box to change operators on-the-fly.

Exit – closes the View and returns to the Windows desktop.

Executing Batches

Once a control recipe is created, it is displayed in the Batch List window. This window lists all batches that are currently executing, waiting to run, or are completed. The information displayed for each batch includes the ID, the recipe procedure, a description, the start time, the elapsed time, the current state, the current mode, the process cell, and he units that are being used. The operator can command any batch listed in the Batch List window. Commands issued from RSBatch are sent through the PLI (phase logic interface, the connecting interface between RSBatch and a particular process-connected device) to the process-connected device.

The RSBatch Server

RSBatch is a client/server application. The Server is the batch execution engine of the RSBatch package. The Server allows integration with today's most popular process-connected device and other software packages. The Server is also responsible for most of the process-intensive functions.

Batch creation, recipe execution, and equipment arbitration are all required for the production of a batch. These functions, along with data collection and electronic batch recording, are performed automatically by the RSBatch Server. The RSBatch Server can use recipes created as binary or relational database fields.

The RSBatch Simulator

The RSBatch Simulator is a powerful tool that allows recipes to be tested against plant configuration(s) without running them in the plant. It can also be configured to match a customer's specific project and/or process-connected device. The Simulator is fully configurable and includes phase modification and changes to phase states during run-time. The Simulator also supports cutover of one phase at a time, speeding the debugging process as startup approaches.

The RSBatch Archiver

The RSBatch Archiver has the ability to run as a Windows NT service, ensuring that the Archiver will always be available for incremental batch archiving. In other words, the Windows NT logon and logoff procedures will not interrupt the Archiver during electronic batch record file creation. The RSBatch electronic batch record file is created during recipe execution and can be redundantly stored on separate computers. The electronic batch record contains the following information fields for every event:

- Date and Time
- Description
- Engineering Units
- Phase Description
- Unit
- Batch ID
- Event Type
- User Name
- Area
- Phase
- Recipe
- Value
- Computer Name
- Process Cell

The RSBatch Archiver can be configured to store the archived information into any relational database that supports the Microsoft ODBC interface standard. Once the information is put into a database, the user can sort and analyze data and create custom reports from the data as desired. Statistical analyses can be performed to determine the effectiveness of a particular process. Currently supported databases include:

- Microsoft Access ™
- Any ODBC-compliant data source
- Sybase ®
- Microsoft SQL Server ™
- Oracle ®

The RSBatch Archiver executable can also be replaced with alternative archive mechanisms, such as Oracle's SQL Loader or Microsoft SQL Server's Import.

The RSBatch Report Editor

The configurable RSBatch Report Editor provides an easy-to- use interface for designing powerful batch reports. The Report Editor produces reports that provide a summary of production information about a particular batch. All phase execution information is available to the Report Editor.

Reports can even provide information on lot tracking, genealogy, and other important characteristics. Reports can be alternatively generated using database or spreadsheet program, or they may be produced using third-party report writing packages such as Crystal Reports™. Either way, the data can be manipulated and formatted to provide reports that are useful to any user.

Process-Connected Devices

The benefits derived from the flexible, configurable, and modular nature of RSBatch are built upon a solid foundation of well-structured phase logic. Phase logic is the application-specific code that resides in the process-connected device. It consists of the control steps and algorithms necessary for the initiation and control of the process functions of the plant.

Ultimately, the production of a batch is dependent upon the mapping, or linking, of recipe phase definitions to equipment phase logic. This modular approach reduces the effort required to implement, validate, and maintain your batch control system. It eliminates the need to develop complex programs to coordinate and control the process. Recipe configuration and simple phase logic modules replace such monolithic programming.

RSBatch System Requirements

- IBM ® -compatible Pentium ® 166 MHz, 256 KB cache
- Minimum 48 MB of RAM
- 1 GB of hard disk space
- Microsoft Windows NT 4.0 Workstation/Server, Service Pack 3
- Using Windows NT 4.0 Server as either the primary or backup domain controller is NOT warranted for use with the RSBatch Server.
- Ensure that all hardware and software are on the current Microsoft Windows NT compatibility list.
- Monitor resolution of at least 800 x 600 pixels (1024 x 768 recommended)
- Ethernet card, network cable, and concentrator required if using twisted pair wiring
- RSBatch requires the use of RSLinx ™ (sold separately) or compatible DDE Server.

RSLoop Optimizer

RSLoop Optimizer™ is the most advanced PID optimization software available today. It includes advanced optimization tools for analyzing and tuning PID control loops in ProcessLogix controllers. Optimizing your process and reducing process variability with RSLoop Optimizer improves productivity and plant efficiency.

Using an intuitive software environment, RSLoop Optimizer automatically develops a process model of the control loop, allowing you to analyze and simulate current operating conditions. Knowing the dynamics of the process model, RSLoop Optimizer applies advanced analysis tools to diagnose PID loop disturbances and suggests optimal proportional, integral, derivative and filtering (PIDF) values. These new values can be tested prior to downloading to your process, allowing you to predict the new loop response and compare improvements with the current settings.

Advanced Data Analysis Tools

Troubleshooting and optimizing control loops can be a complex and time-consuming process. RSLoop Optimizer was designed specifically to address this issue and can reduce the time to optimize your loops from days to minutes. The advanced data analysis tool set includes features to reduce downtime and increase operating efficiency.

Data Analysis Tools

Characterizer: helps to linearize your process for optimal performance across the entire range

Power spectral density plots: identifies potential process equipment deficiencies, shows the relative power in the signal at various frequencies

Relative Response Time (RRT) tool: indicates the speed of a control loop and aids in decoupling interacting loops

Stiction Wizard: determines if valve stiction is degrading performance

PID Tuning Table: helps you select the best tuning values for a control loop

Valve Wear indicators: predicts valve failure through these tools:

- Valve Travel–determines total distance the controller moves in a given time
- Valve Reversal–plots the number of time the controller output changes direction in a given time

Robustness Plots: analyzes the trade-off between tight tuning and stability, shows how sensitive your loop is to process gain or process dead-time changed

Auto- and cross-correlation graphs: determines the relative amount of interdependency either between two loops (cross correlation), or the relative amount of variability that the loop causes with it's own control (auto correlation)

pH Linearizer: allows easy pH tuning by linearizing the control loop over the entire range of control

Additional trend lines: provides the ability to add additional trend lines so you can examine and tune multiple loops from the same trend interface

Histogram plot: plots the statistical spread of your data, displays a histogram of error, PV, or CO

Extensive reporting capabilities: gives you the option of adding analysis plots and data directly into your report and provides the means for you to customize the report template to suit your needs

Tuning Optimization

Process Model: analyzes the control loop online and generates the process model of the loop, uses your process frequency response to identify the model based on two modeling methods:

- allow the gain to float–causes RSLoop Optimizer to ignore steady state information and fit the model based on higher frequencies
- force steady state gain–forces the steady state gain to be equal to the amplitude ratio at the lowest frequency

Process Frequency Response Plot: shows both the actual and model process frequency responses for comparison purposes, uses this information to calculate new tuning parameters based on your control requirements

Control Loop Simulation Plot: shows the system response to either a load upset or a set point change, graphs the response for both the current and new PID parameters so the responses can be compared

PV Filter Analysis: filters the process variable input to improve your loop performance, automatically calculates the maximum filter value without degrading your process for the filter chosen

Setpoint Filter Analysis: optimizes responses to both setpoint changes and load upsets by filtering the affect of a setpoint change

Performance Summary: allows you to view overall trade-offs of performance, and robustness at a glance, the performance summary includes:

- performance increase
- robustness increase
- current relative response time
- new relative response time

Inverse Response: tunes difficult level loops found in re-boil and distillation column applications, provides vital analysis

Noise simulation: allows what-if testing to determine whether or not filtering will improve performance of your loop

Function Blocks: supports function block tuning in ProcessLogix and ControlLogix controllers, tuning parameters are downloaded directly to the PID memory table automatically

Easy-to-Use Communication Setup

RSLoop Optimizer lets you configure communication to your processor. RSLinx ™ can be used to communicate with the processor controlling your PID instruction address.

RSLoop Optimizer includes a software simulation file that you can use to learn the operation of the software. It does not require an actual processor or any additional communication software to operate. Using the software simulation file, you can perform all the functions of RSLoop Optimizer, including filtering, editing, advanced analysis, and simulated downloading of new tuning parameters.

Note: RSLoop Optimizer requires the use of the full feature version of RSLinx. RSLinx OEM will communicate with RSLoop Optimizer via OPC only. **RSLoop Optimizer will not work with RSLinx Lite.**

The loop simulator provides advanced simulation, including cascade and feed-forward loops with multiple simultaneous simulations on the same plot for easy comparison.

AutoTune Sequence

The RSLoop Optimizer AutoTune is a sequence of questions that you can follow to have RSLoop Optimizer automatically calculate new PID and Filter tuning parameters for your control loop. After the new PID and Filter values are calculated, you will be able to download them directly from the faceplate.

The AutoTune sequence reduces the amount of time required to tune a loop and minimizes product waste and rework. This feature also helps ensure that you have optimal data when calculating new tuning parameters.

You can also manually collect data for those loops that may require special techniques.

RSLoop Optimizer supports simultaneous displaying of multiple faceplates. This is useful when process dependencies are present. Observing multiple faceplates allows you to see the effects of one control loop on another.

Faceplate and Trend

RSLoop Optimizer allows you to select either set point (Lambda) tuning, or load type tuning. Various settings may be tested prior to downloading using the advanced analysis methods available. RSLoop Optimizer will also display the probable performance increase of new setting so you can choose the best possible settings for your application.

To optimize your data prior to calculating new tuning parameters, you may zoom in on any portion of the data, edit out unwanted information, or apply filtering to smooth the response.

Loop notes may be added for each PID loop, including those that have been filtered or edited. A ‘Created from’ comment is automatically added to the notes section when data is edited.

RSLoop Optimizer Features

ProcessLogix support through OPC Automation: RSLoop Optimizer is an OPC client (RSLinx 2.1 and above only)

Extra trend: an extra trend can be added to allow you to watch another variable in the same trend

Viewing of real-time trend values: real-time trend values can be viewed as ToolTips by positioning the cursor on the trend line

View part of a Control Loop simulation: Easily expand or halve the range on the simulation plot. Lets you view the part of the simulation that interests you most.

Seamless connectivity to your control loops: RSLoop Optimizer uses RSLinx™ Standard, Professional or OEM (OPC only) for all supported processors. RSLoop Optimizer does not work with RSLinx Lite.

Archiving: Manual archiving of multiple sets of data allows easy before and after analysis

PID loop tuning categories: Categories can be selected for load tuning or setpoint tuning from the simulation plot

Pre-download setting analysis: Allows you to see the performance of your loops before actually downloading them to the controller

Data optimization: Data can be zoomed, filtered, averaged, and line edited

Control loop testing: RSLoop Optimizer includes powerful analysis plots that provide critical performance information on your loops.

RSLoop Optimizer System and Software Requirements

- IBM®-compatible 486 or greater (Pentium™ recommended)
- Microsoft® Windows® 95, Windows 98, Windows 2000, Windows NT™ (4.0, Service Pack 3 or 4)
- If reporting function is used, Microsoft® Word 97 with SR-1 or higher
- 8 MB of hard disk space (or more based on application requirements)
- 16-color VGA graphics adapter 640 x 480 (256-color or higher, 800 x 600 recommended)
- Any Windows-compatible pointing device
- Communications software
  - Windows NT: RSLinx 1.50.58 (or higher) or ProcessLogix 3.0.0 (or higher)
  - Windows 95 / 98 / 2000: RSLinx 1.50.58 (or higher)

ProcessLogix R320.0 Supported 1757 Series Specifications

Rockwell Testing

During recent Rockwell testing of the 1757-PLX52, we found the following:

- 1757-PLX52 can exchange data via exchange blocks from one PLX52, to up to nine different PLX52s.
- Once you create a DDE/OPC topic configuration in RSLinx, you can then paste a link into an MS-Excel spreadsheet to monitor data from within a PLX52.
- 1757-PLX52 can communicate via exchange blocks to a 1747-L542P (SLC) processor via the DH+ network.
- PanelView 1000 can talk, via exchange blocks, to a PLX52 processor.

1757-PLX52 Specifications

The following table contains specifications for the 1757-PLX52 controller.

Table 4.A 1757-PLX52 Controller Specifications

Parameter	Operation and Storage Limits	Transportation Band
Ambient Temp Range	0 to +60°C no fans	-40 to 85°C
Temp. Rate of Change	≤ 1°C/min.	≤ 5°C/min.
Relative Humidity (non-condensing)	5 to 95%	5 to 95%
Vibration (3 axes) Frequency Acceleration Displacement	 10 to 60 Hz 0.5 g max. 0.1 inches	 10 to 60 Hz 1 g max. 0.1 inches
Mechanical Shock Acceleration Duration	 5 g max. 30 ms max.	 20 g max. 30 ms max.
Barometric Pressure Altitude	 -300 to +2000 m	 Any
Corrosives	G2 std, G3 option (ISA S71.04)	G3
Module Power Requirements	+5.1 V_dc @ 1.5 A +3.3 V_dc @ 1.0 A	

Table 4.A 1757-PLX52 Controller Specifications

Parameter	Operation and Storage Limits	Transportation Band
Module Battery Backup Time Lithium Battery (standard, built in) Battery Extension Module (1757-BEM)	144 hours (non-rechargeable, replaceable) - 6 days battery replacement catalog number: 1757-PLXBAT 120 hours (rechargeable) - 5 days	Lithium battery is disconnected during shipment.
Mean Time Between Failure	106,358 hours (operating continuously at 25°C)	
Removal/Insertion under power (RIUP)	NOT PERMITTED	
CE Conformity (Europe)	89/336/EEC, EMC Directive EN 50081-2, Emissions, Industrial EN 50082-2, Immunity, Industrial	N/A
Agency Certifications When product is marked	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Groups A, B, C, D or nonhazardous locations Marked for all applicable directives Marked for all applicable acts N314	

IMPORTANT This section contains only those modules that are currently supported by ProcessLogix R320.0. We offer many I/O modules not listed here and we continue to add support for I/O modules currently not supported.

For a complete listing of all our modules, refer to these publications:

- 2001 Rockwell Automation/Allen-Bradley Asset Management Catalog, SUPR-CA027A-EN-P
- Master Price List - USA, CIG-3.0

Module Specifications

The following tables list specifications for 1757-series modules. All modules in this chapter can be conformally coated for protection.

Table 4.B ProcessLogix Battery Extension Module Cat. No. 1757-BEM Specifications

1757-BEM Specifications	
Electrical	
backplane current	5.1V dc @ 112 mA 24V dc @ 36 mA
power dissipation	1.424 watts
Environmental	
operating temperature	0 to 60°C
storage temperature	-40 to 85°C
relative humidity	5 to 95% without condensation
Physical	
chassis location	slot 6 in 7- or 13-slot
(recommended default)	slot 4 in 10- or 17-slot
weight	0.35 kg
voltage/current ratings	30 v ac/dc maximum / 100 milliamps maximum
channels	one
ground isolation	1500V ax
Agency Certification (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified for use in Class I, Division 2, Groups A, B, C, D Marked for all applicable directives Approved Class I, Division 2, Group A, B, C, D Marked for all applicable acts N314

Table 4.C ControlNet-to-Foundation Fieldbus H1 Linking Device Cat. No. 1757-CN2FF Specifications

1757-CN2FF Specifications	
Environmental	Operating Temperature: 0 to 60° C (32 to 140°F) Storage Temperature:-40 to 85° C (-40 to 185°F) Relative Humidity: 5 to 90% (non-condensing)
Vibration	Operating - 2Gs each axis Tested 2Gs @ 10 - 500 Hz per IEC 68-2-6
Communication	ControlNet - redundant media and network access port Foundation Fieldbus H1, 2 independent channels LAS on both channels Time Master on both channels
Power Requirements	11-30V dc; 270 mA @ 24Vdc (typical)
Indicators	Module Status Fieldbus Status, 1 each connection ControlNet Status, 1 each connection
Connectors	ControlNet - BNC connectors Network Access Port - RJ45 Fieldbus - 9-pin sub-D connectors Power Input Terminals: • Torque 5-7 in-lb. • Not to be used with combination of solid and stranded 16 BA wire
Conductors/Wire Size/Category	Category 2[1]
Mounting	35 mm DIN rail
ControlNet Channel Selection	2, 10-position rotary switches
Agency Certification (when product or packaging is marked)	UL Listed Industrial Control Equipment UL Listed Industrial Control Equipment for use in Canada UL Listed Industrial Control Equipment for use in Class I, Div 2 Hazardous Locations EN 50082-1, 2 EN 55022, Radiated Emission Class A EN 61131-2 Marked for all applicable directives FCC Part 15, SubPart B

[1] Refer to the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Table 4.D ProcessLogix Pulse Input Module Cat. No. 1757-PIM Specifications

1757-PIM Specifications	
Input Channel Characteristics:	
Number of Input Channels	Up to 8 input channels are capable of pulse counting • 6 channels are also capable of frequency and pulse width calculation • 2 channels have associated outputs and frequency calculation
Input configuration	Single-ended
Input Voltage Range	5 to 24 Vdc selectable betw4een high input range (logic high threshold at approx. 8.80V typical) and low input range (logic high threshold at approx. 3.25V typical)
Input Required Current	12.5mA Max. (for high input range 6mA typical; for low input range 2mA typical)
Hysteresis Minimum	Low Input Range: 550mV, minimum High Input Range: 900mV
Frequency Range	100KHz Maximum
Isolation Voltage	Terminal Block to Backplane: 1500V Channel-to-Channel: 1500V
Accumulated Value Size	32 bits
Output Channels	Up to 2 output channels are available Output current is capable of 500mA with an external power supply
Isolation Voltage	Terminal Block to Backplane: 1500B Channel-to-Channel: 1500V
Environmental[1]:	
Operating/Storage Temperature	0 to 60ºC (32 to 140ºF) with no fans
Transportation Band	-40 to 85ºC (-40 to 185ºF)
Temperature	50 to 95% non-condensing up to 40ºC (104ºF)
Relative Humidity	50 to 95% non-condensing above 40ºC (104ºF)

[1] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

1757-PIM Specifications			
Vibration:	Frequency	Acceleration	Displacement
Operating/Storage Vibration (3 axes)	10-60Hz	0.5g Max.	0.1 inches (0.254cm)
Transportation Band vibration (3axes)	0-60Hz	1g Max.	0.1 inches (0.254cm)
Mechanical Shock:	Duration	Acceleration	
Operating/Storage Shock	30ms Max.	5g Max.	
Transportation Shock	30ms Max.	20g Max.	
Barometric Pressure: Operating/Storage Altitude Transportation Band Altitude	 -300 to +3000m (-984 to 9843 ft.) Any		
Corrosives: With Enclosure Enclosure External Temperature Limits	 G2 standard, G3 option (ISA S71.04) TBD		
CE Mark Standard Compliance:	Yes		
Electromagnetic Interference	15B/m, SAMA Standard PMC 33.3-1978 Class 2 or same as CE Mark (whichever is more severe)		
Electrostatic Discharge	Same as CE Mark, IEC801-2, plus 15kV to enclosure, controller surfaces and min. 10kV to all field wires		
Surge Protection	Same as CE Mark, IEC801-4 and 5 or IEEESWC 472-1989 (whichever is more sever)		
Agency Certifications (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Groups A, B, C, D or nonhazardous loc Marked for all applicable directives Approved Class I, Division 2, Group A, B, C, D Marked for all applicable acts N314		

Table 4.E ProcessLogix/ControlLogix System Redundancy Module Cat. Nos. 1757-SRM/A, 1757-SRM/B

1757-SRM/A, SRM/B Specifications		
Electrical	backplane current	0.75 amp@3.3VDC 1.0 amp@5.1 VDC 0.090 amp@24 VDC
	power dissipation	9.6 watts
	thermal dissipation	9.6 watts
Environmental [1]	operating temperature	0 to 60 deg. C
	storage temperature	-40 to 85 deg. C
	relative humidity	5 to 95% without condensation
Physical	module type	redundancy
	module size	(ICP std. 2 slots wide)
	chassis location (recommended default)	slots 5-6 in 10-slot and slots 4-5 in 7-slot and 13-slot 17-slot
	weight	0.452 kg
Redundancy Cable Interfaces	connectors	ST-type (fiber-optic)
	cable type	62.5/125 micron multi-mode fiber-optic cable
	channels	one (transmit and receive fiber)
	ground isolation	N/A (fiber-optic interface)
Status Contact Cable Interface 1757-SRM/B only	connectors	2-terminal Weidmuller #150191 mating connector supplied with redundancy module for use on user cable.
	cable type	shielded pair; conductor size range = AWG #14-22
	voltage/current ratings	30 v ac/dc maximum / 100 milliamps maximum
	channels	one
	ground isolation	tested to 1500 vac for 60s
Agency Certifications (when product or package is marked)		Listed Industrial Control Equipment Certified Process Control Equipment Certified for use in Class I, Division 2, Groups A, B, C, D Approved Class I, Division 2, Groups A, B, C, D Marked for all applicable directives Marked for all applicable acts N314

[1] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

ProcessLogix R320.0 Supported 1756 Series Specifications

Rockwell Testing

During recent Rockwell testing of the 1756 series, we found the following:

- 1757-PLX52 can communicate to as many as 64, assorted 1756 I/O modules in a scheduled environment using RSNetworx.
- 1757-PLX52 can exchange data via exchange blocks to a PLC-5/40E by using the 1756-ENET module.
- A redundant 1757-PLX52 can communicate to as many as 56, assorted 1756 I/O modules, and as many as 4, 1756-CN2FF linking devices, in a scheduled environment using RSNetworx.

IMPORTANT Tested modules include: 1756-IA8D, 1756-OA8D, 1756-IF16, 1756-OF6CI, 1756-OF8, 1756-IB16, 1756-OB16, 1756-IB16D, 1756-OB16D, 1756-IB32, 1756-OB32.

ControlLogix Controllers Specifications

The following table shows the specifications for all of the R320.0 supported ControlLogix Controllers.

Table 5.A ControlLogix Controllers Specifications

Specification	1756-L1	1756-L1M1	1756-L1M2	1756-L1M3	1756-L55M13	1756-L55M14	1756-L55M16
user available memory[1]	64 Kbytes	512 Kbytes	1 Mbyte	2 Mbytes	1.5 Mbytes	3.5 Mbytes	7.5 Mbytes
backplane current +5V dc +24V dc	 0.65A 0.02A	 0.95A 0.02A	 1.05A 0.02A	 1.20A 0.02A	 1.15A 0.02A	 1.25A 0.02A	 1.40A 0.02A
average power dissipation	3.0W	3.75W	4.0W	4.25W	4.50W	4.75W	5.0W
average thermal dissipation	10.2 BTU/hr	12.8 BTU/hr	13.7 BTU/hr	14.5 BTU/hr	15.4 BTU/hr	16.2 BTU/hr	17.1 BTU/hr
environmental[2] operating temperature storage temperature relative humidity	0° to 60° C (32 to 140° F) -40° to 85° C (-40 to 185° F) 5% to 95% noncondensing						
vibration	10 to 500 Hz 2.0 G maximum peak acceleration						

Table 5.A ControlLogix Controllers Specifications

Specification	1756-L1	1756-L1M1	1756-L1M2	1756-L1M3	1756-L55M13	1756-L55M14	1756-L55M16
operating shock	30G peak for 11ms						
storage shock	50G peak for 11ms						
weight	10.0 oz.	12.5 oz.	12.5 oz.	12.7 oz.	12.5 oz.	12.8 oz.	13.4 oz.
programming cable	1756-CP3 or 1747-CP3 serial cable category 3[3]						
battery	1756-BA1 (PROMARK Electronics 94194801) 0.59g lithium						
agency certification (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Marked for all applicable directives Marked for all applicable acts N223						

[1] Available user memory is the amount of memory available to the user after RSLogix 5000 programming software is connected and a null program is loaded.

[2] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

[3] Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

1756 Series Analog I/O Common Specifications

See Table 5.B for specifications common to all supported analog I/O modules (except when included in individual tables with notations).

Table 5.B Common Module Specifications

1756 Analog Specifications	
Module Location	1756 ControlLogix Chassis
Data Format	Integer mode (2s complement) Floating point IEEE 32 bit
Environmental Conditions[1] Operating Temperature Storage Temperature Relative Humidity	 0 to 60°C (32 to 140°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing
Conductors Wire Size Category	 22-14 AWG (2mm^2) stranded[2] 3/64 inch (1.2mm) insulation maximum 2[3][4]
All modules in this chapter can be conformally coated for protection.	
Agency Certification (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Approved Class I, Division 2, Group A, B, C, D Marked for all applicable directives[5]

[1]This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

[2]Maximum wire size will require extended housing - 1756-TBE.

[3]Use conductor category information for planning conductor routing as described in the system level installation manual.

[4]Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

[5]Shielded cable required.

IMPORTANT

This section contains only those modules that are currently supported by ProcessLogix R320.0. We offer many I/O modules not listed here and we continue to add support for I/O modules currently not supported.

For a complete listing of all our modules, refer to these publications:

- 2001 Rockwell Automation/Allen-Bradley Asset Management Catalog, SUPR-CA027A-EN-P
- Master Price List - USA, CIG-3.0

Module Specifications

The following tables list specifications for 1756-series analog I/O modules.

Table 5.C 16 pt. Non-isolated Analog Current/voltage Input Module Cat. No. 1756-IF16 Specifications

1756-IF16 Specifications	
Number of Inputs	16 single ended, 8 differential or 4 differential (high speed)
Backplane Current	150mA @ 5.1V dc & 65mA @ 24V dc (2.33W)
Power Dissipation within Module Thermal Dissipation	2.3W voltage 3.9W current 7.84 BTU/hr voltage 13.30 BTU/hr current
Input Range and Resolution	+/-10.25V, 0-10.25V, 0-5.125V, 0-20.5mA
Input Impedance Voltage Current	 >1megΩ 249Ω
Open Circuit Detection Time	Differential voltage - Positive full scale reading within 5s Single Ended/Diff. current - Negative full scale reading within 5s Single Ended voltage -Even numbered channels go to positive full scale reading within 5s, odd numbered channels go to negative full scale reading within 5s
Overvoltage Protection	30V dc voltage 8V dc current
Normal Mode Noise Rejection(1)	>80dB at 50/60Hz
Common Mode Noise Rejection	>100dB at 50/60Hz
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.05% of range - voltage Better than 0.15% of range - current
Input Offset Drift with Temperature	45µV/degree C
Gain Drift with Temperature	15 ppm/degree C - voltage 20 ppm/degree C - current
Module Error over Full Temp. Range	0.1% of range - voltage 0.3% of range - current
Module Scan Time for All Channels (Sample Rate Module Filter Dependent)	16 pt single ended - 16-488ms 8 pt differential - 8-244ms 4 pt differential - 5-122ms
Module Conversion Method	Sigma-Delta
Isolation Voltage User to system	 100% tested at 2550V dc for 1s
Module Keying (Backplane)	Electronic
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm)
RTB Keying	User defined
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)
Screwdriver Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

(1) This specification is module filter dependent.

Table 5.D 6 pt. Isolated Analog Current/voltage Input Module Cat. No. 1756-IF6I Specifications

1756-IF6I Specifications	
Number of Inputs	6 individually isolated channels
Backplane Power Requirements (No module external power requirements)	250mA @5.1V dc & 100mA @ 24V dc (3.7W)
Power Dissipation within Module Thermal Dissipation	3.7W voltage 4.3W current 12.62 BTU/hr voltage 14.32 BTU/hr current
Input Range	+/-10.5V, 0-10.5V, 0-5.25V, 0-21mA
Resolution +/-10.5V range 0 to 10.5V range 0 to 5.25V range 0-21mA range	Approximately 16 bits across each range shown below 343µV/count 171µV/count 86µV/count 0.34µA/count
Input Impedance	>10MΩ Voltage, 249Ω Current
Open Circuit Detection Time	Positive full scale reading within 5s
Overvoltage Protection	120V ac/dc (Voltage ranges) 8V ac/dc with on-board current resistor (Current Ranges)
Normal Mode Noise Rejection(1)	60dB at 60Hz
Common Mode Noise Rejection	120dB at 60Hz, 100dB at 50Hz
Channel Bandwidth1	15Hz (-3dB)
Settling Time to 5% of Full Scale(1)	<80ms
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.1% of range 12 months typical
Input Offset Drift with Temperature	2µV/degree C typical
Gain Drift with Temperature	35 ppm/degree C typical (80 ppm maximum) Voltage 45 ppm/degree C typical (90 ppm maximum) Current
Module Error over Full Temp. Range	0.54% of range
Minimum Module Scan Time for all Channels(1) (Sample Rate)	25ms minimum floating point 10ms minimum integer
Isolation Voltage Channel to channel User to system	Optoisolated, transformer isolated 100% tested at 1700V dc for 1s 100% tested at 1700V dc for 1s
Module Conversion Method	Sigma-Delta
Module Keying (Backplane)	Electronic
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

(1) These specifications are notch filter dependent.

Table 5.E 6 pt. Isolated RTD Input Module Cat. No. 1756-IR6I Specifications

1756-IR6I Specifications	
Number of Inputs	6 individually isolated channels
Backplane Power Requirements (No external power requirements)	250mA @ 5V dc & 125mA @ 24V dc (4.25W)
Power Dissipation within Module Thermal Dissipation	4.3W 14.66 BTU/hr
Input Range	1-487Ω, 2-1000Ω, 4-2000Ω, 8-4020Ω
Resolution in Ranges 487Ω 1000Ω 2000Ω 4020Ω	Approximately 16 bits across each input range 7.7mΩ/count 15mΩ/count 30mΩ/count 60mΩ/count
Sensors Supported	Resistance 4-4020Ω 100, 200, 500, 1000Ω Platinum, alpha=385 100, 200, 500, 1000Ω Platinum, alpha=3916 120Ω Nickel, alpha=672 100, 120, 200, 500Ω Nickel, alpha=618 10Ω Copper
Open Circuit Detection Time	Positive full scale reading within 5s with any combination of lost wires, except input terminal B alone. If input terminal B is lost by itself, the module reads a negative full scale reading within 5s.
Overvoltage Protection	24V ac/dc maximum
Normal Mode Noise Rejection(1)	60dB at 60Hz
Common Mode Noise Rejection	120dB at 60Hz, 100db at 50Hz
Channel Bandwidth(1)	15Hz
Settling Time to 5% of Full Scale(1)	<80ms
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.1% of range 12 months typical
Input Offset Drift with Temperature	10mΩ/degree C
Gain Drift with Temperature	50 ppm/degree C typical (90 ppm maximum)
Module Error over Full Temp. Range	0.54% of range
Module Scan Time for all Channels(1) (Sample Rate)	25ms minimum floating point (ohms) 50ms minimum floating point (temperature) 10ms minimum integer (ohms)
Module Conversion Method	Sigma-Delta
Isolation Voltage Channel to channel User to system	Optoisolated, transformer isolated 100% tested at 1700V dc for 1s 100% tested at 1700V dc for 1s
Module Keying (Backplane)	Electronic
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(2)
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

(1)These specifications are notch filter dependent.

(2)Maximum wire size will require extended housing - 1756-TBE.

Table 5.F 6 pt. Isolated Thermocouple/mV Input Module Cat. No. 1756-IT6I Specifications

1756-IT6I Specifications	
Number of Inputs	6 individually isolated channels
Backplane Power Requirements (No external power requirements)	250mA @ 5.1V dc & 125mA @ 24V dc (4.3W)
Power Dissipation within Module Thermal Dissipation	4.3W 14.66 BTU/hr
Input Ranges	-12mV to +78mV -12mV to +30mV (high resolution range)
Supported Thermocouple Types	B, C, E, J, K, N, R, S, T Linearization based on ITS-90
Resolution	16 bits (1.4µV typical) 0.7µV/count on high resolution range
Input Impedance	>10MΩ
Open Circuit Detection Time	Positive full scale reading within 2s
Overvoltage Protection	120V ac/dc maximum
Normal Mode Noise Rejection(1)	60dB at 60Hz
Common Mode Noise Rejection	120dB at 60Hz, 100dB at 50Hz
Channel Bandwidth(1)	15Hz
Settling Time to 5% of Full Scale(1)	<80ms
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.1% of range 12 months typical
Accuracy (Cold Junction Sensor) Local CJ Sensor Uncertainty Remote CJ Sensor	 From +/-0.3 up to +/-3.2°C, depending on channel +/-0.3°C
Input Offset Drift with Temperature	0.5µV/degree C typical
Gain Drift with Temperature	65 ppm/degree C typical (80 ppm maximum)
Module Error over Full Temp. Range	0.5% of range
Minimum Module Scan Time for all Channels[1] (Sample Rate)	25ms minimum floating point (millivolt) 50ms minimum floating point (temperature) 10ms minimum integer (millivolt)
Module Conversion Method	Sigma-Delta
Isolation Voltage Channel to channel User to system	Optoisolated, transformer isolated 100% tested at 1700V dc for 1s 100% tested at 1700V dc for 1s
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Electronic
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(2)
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

(1) These specifications are notch filter dependent. Values represent 60Hz setting.

(2) Maximum wire size will require extended housing - 1756-TBE.

Table 5.G 6 pt. Isolated Analog Current Output Module Cat. No. 1756-OF6CI Specifications

1756-OF6CI Specifications	
Number of Outputs	6 individually isolated channels
Backplane Power Requirements (No external power requirements)	250mA @ 5.1V dc & 225mA @ 24V dc (0-550Ω loads terminated on OUTs and RTNs) (6.7W) 250mA @ 5.1V dc & 300mA @ 24V dc (551-1000Ω loads terminated on OUTs and ALTs) (8.5W)
Power Dissipation within Module Thermal Dissipation	5.5W (0-550Ω loads) 6.1W (551-1000Ω loads) 18.76 BTU/hr (0-550Ω loads) 20.80 BTU/hr (551-1000Ω loads)
Output Current Range	0 to 21mA
Current Resolution	13 bits across 21mA (2.7µA)
Data Format	Integer mode (Left justified, 2s complement) Floating point IEEE 32 bit
Open Circuit Detection	None
Output Overvoltage Protection	24V ac/dc maximum
Output Short Circuit Protection	Electronically current limited to 21mA or less
Drive Capability	0-1000Ω Separate field terminations for ranges 0-550Ω or 551-1000Ω
Output Settling Time	<2ms to 95% of final value with resistive loads
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.1% of range from 4mA to 21mA 12 months typical
Output Offset Drift with Temperature	1 µA/degree C typical
Gain Drift with Temperature	60 ppm/degree C typical (100 ppm maximum)
Module Error over Full Temp. Range	0.6% of range
Minimum Module Scan Time for All Channels	25ms minimum floating point 10ms minimum integer
Isolation Voltage Channel to channel User to system	Optoisolated, transformer isolated 100% tested at 1700V dc for 1s 100% tested at 1700V dc for 1s
Module Conversion Method	R-Ladder DAC, monotonicity with no missing codes
Inductive Load	<1 mH
Module Keying (Backplane)	Electronic
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

[1]Maximum wire size will require extended housing - 1756-TBE.

Table 5.H 6 pt. Isolated Analog Voltage Output Module Cat. No. 1756-OF6VI Specifications

1756-OF6VI Specifications	
Number of Outputs	6 individually isolated channels
Backplane Power Requirements (No external power requirements)	250mA @ 5.1V dc & 175mA @ 24V dc (5.5W)
Power Dissipation within Module Thermal Dissipation	4.85W 16.54 BTU/hr
Output Voltage Range	+/- 10.5V maximum
Voltage Resolution	14 bits across 21V (1.3mV) (13 bits across 10.5V +sign bit)
Data Format	Integer mode (Left justified, 2s complement) Floating point IEEE 32 bit
Output Impedance	<1Ω
Open Circuit Detection	None
Output Overvoltage Protection	24V ac/dc maximum
Output Short Circuit Protection	Electronically current limited
Drive Capability	≥1000Ω loads, 10mA maximum
Output Settling Time	<2ms to 95% of final value with resistive loads
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.1% of range 12 months typical
Output Offset Drift with Temperature	60 µV/degree C typical
Gain Drift with Temperature	50 ppm/degree C typical (80 ppm maximum)
Module Error over Full Temp. Range	0.5% of range
Minimum Module Scan Time for all Channels	25ms minimum floating point 10ms minimum integer
Isolation Voltage Channel to channel User to system	Optoisolated, transformer isolated 100% tested at 1700V dc for 1s 100% tested at 1700V dc for 1s
Module Conversion Method	R-Ladder DAC, monotonicity with no missing codes
Capacitive Load	<1 µFd
Module Keying (Backplane)	Electronic
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

[1]Maximum wire size will require extended housing - 1756-TBE.

Table 5.I 8 pt. Non-isolated Analog Current/voltage Output Module Cat. No. 1756-OF8 Specifications

1756-OF8 Specifications	
Number of Outputs	8 voltage or current outputs
Backplane Current	150mA @ 5.1V dc & 210mA @ 24V dc (5.8W)
Power Dissipation within Module Thermal Dissipation	4.92W - 8 channel current 16.78 BTU/hr
Output Range	0 to 21mA +/- 10.4V
Resolution	15 bits across 21mA - 650nA/bit 15 bits across 10.4V - 320μV/bit
Open Circuit Detection	Current output only (Output must be set to >0.1mA)
Output Overvoltage Protection	24V dc
Output Short Circuit Protection	Electronically current limited to 21mA or less
Drive Capability	>2000Ω - voltage 0-750Ω - current
Output Settling Time	<2ms to 95% of final value with resistive loads
Calibrated Accuracy at 25°C Calibration Interval	Better than 0.05% of range from 4mA to 21mA, -10.4V to 10.4V Twelve months typical
Output Offset Drift with Temperature	50 μV/degree C typical 100nA/degree C typical
Gain Drift with Temperature	25 ppm/degree C maximum - voltage 50 ppm/degree C maximum - current
Module Error over Full Temp. Range	0.15% of range - voltage 0.3% of range - current
Module Scan Time for all Channels	12ms minimum floating point 8ms minimum integer
Isolation Voltage User to system	 100% tested at 2550V dc for 1s
Module Conversion Method	R-Ladder DAC, monotonicity with no missing codes
Module Keying (Backplane)	Electronic
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.B on page 5-3 for specifications common to all 1756 analog I/O modules	

[1]Maximum wire size will require extended housing - 1756-TBE.

1756 Series Digital I/O Common Specifications

See Table 5.J for specifications common to all digital I/O modules (except when included in individual tables with notations).

Table 5.J Common Module Specifications

1756 Digital Specifications	
Module Location	1756 ControlLogix Chassis
Environmental Conditions[1] Operating Temperature Storage Temperature Relative Humidity	 0 to 60°C (32 to 140°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing
Conductors Wire Size[2] Category	 22-14 AWG (2mm^2) stranded 3/64 inch (1.2mm) insulation maximum 1[3], [4]
All modules in this chapter can be conformally coated for protection.	
Agency Certification (when product or packaging is marked)	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Approved Class I, Division 2, Group A, B, C, D Marked for all applicable directives

[1] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

[2] Maximum wire size will require extended housing - 1756-TBE.

[3] Use this conductor category information for planning conductor routing as described in the system level installation manual.

[4] Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Module Specifications

The following tables list specifications for 1756-series digital I/O modules.

Table 5.K 79-132V ac 16 Point Digital Input Module Cat. No. 1756-IA16 Specifications

1756-IA16 Specifications	
Number of Inputs	16 (8 points/common)
Backplane Current	105mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	5.8W @ 60°C
Thermal Dissipation	18.41 BTU/hr
On-State Voltage Range	74-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	5mA @ 74V ac minimum 13mA @ 132V ac maximum
Maximum Off-State Voltage	20V
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	10.15kΩ @ 60Hz
Input Delay Time Off to on Hardware delay On to off Hardware delay	 Programmable filter: 1ms & 2ms 10ms maximum plus filter time Programmable filter: 9ms & 18ms 8ms maximum plus filter time
Diagnostic Functions Change of State Time stamp of Inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Change of State on Inputs	Software configurable (Within 200µs)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups.) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(1)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

(1) Maximum wire size will require extended housing - 1756-TBE.

Table 5.L 79-132V ac 16 Point Isolated Digital Input Module Cat. No. 1756-IA16I Specifications

1756-IA16I Specifications	
Number of Inputs	16 (individually isolated)
Backplane Current	125mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.71W)
Maximum Power Dissipation (Module)	4.9W @ 60°C
Thermal Dissipation	16.71 BTU/hr
On-State Voltage Range	79-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	5mA @ 79V ac, 47-63Hz minimum 15mA @ 132 V ac, 47-63Hz, maximum
Maximum Off-State Voltage	20V ac
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	8.8kΩ @ 60Hz
Input Delay Time Off to on Hardware delay On to off Hardware delay	 Programmable filter: 1ms & 2ms 10ms maximum plus filter time Programmable filter: 9ms & 18ms 8ms maximum plus filter time
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Short/Inrush Current	250 mA peak (decaying to <37% in 22 ms, without activation)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)(1)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

(1)Maximum wire size will require extended housing - 1756-TBE.

Table 5.M 79-132V ac 8 Point Diagnostic Digital Input Module Cat. No. 1756-IA8D Specifications

1756-IA8D Specifications	
Number of Inputs	8 (4 points/common)
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	4.5W @ 60°C
Thermal Dissipation	15.35 BTU/hr
On-State Voltage Range	79-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	74V @ 5mA ac, 47-63Hz minimum 16mA @ 132V ac, 47-63Hz maximum
Maximum Off-State Voltage	20V
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	8.25kΩ @ 60Hz
Input Delay Time Off to on Hardware Delay On to Off Hardware Delay	 Programmable filter: 1ms & 2ms 10ms maximum plus filter time Programmable filter: 9ms & 18ms 8ms maximum plus filter time
Diagnostic Functions Open Wire Loss of Power Time Stamp of Diagnostics Change of State Time stamp of Inputs	 Off state leakage current 1.5mA minimum Transition range 46 to 85V ac +/- 1ms Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User Selectable (100µs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

Table 5.N 10-30V dc Diagnostic Digital Input Module Cat. No. 1756-IB16D Specifications

1756-IB16D Specifications	
Number of Inputs	16 (4 points/common)
Backplane Current	150mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.84W)
Maximum Power Dissipation (Module)	5.8W @ 60°C
Thermal Dissipation	19.78 BTU/hr
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
On-State Current	2mA @ 10V dc minimum 13mA @ 30V dc maximum
Maximum Off-State Voltage	5V dc
Minimum Off-State Current	1.5mA per point
Maximum Input Impedance @ 30V dc	2.31kΩ
Input Delay Time Off to on Hardware On to off Hardware delay	 Programmable filter: 0ms, 1ms & 2ms 1ms maximum plus filter time Programmable filter: 0ms, 1ms, 9ms & 18ms 4ms maximum plus filter time
Diagnostic Functions Open wire Time stamp of diagnostics Change of state Time stamp on inputs	 Off-state leakage current 1.2mA minimum +/- 1ms Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)(1)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

(1)Maximum wire size will require extended housing - 1756-TBE.

Table 5.O 10-30V dc 16 Point Isolated Digital Input Module Cat. No. 1756-IB16I Specifications

1756-IB16I Specifications	
Number of Inputs	16 (individually isolated)
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.45W)
Maximum Power Dissipation	5W @ 60°C
Thermal Dissipation	17.05 BTU/hr
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
On-State Current	2mA @ 10V dc minimum 10mA @ 30 V dc maximum
Maximum Off-State Voltage	5V dc
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 30V dc	3kΩ
Input Delay Time Off to on Hardware delay On to off Hardware delay	 Programmable filter: 0ms, 1ms or 2ms 1ms maximum plus filter time Programmable filter: 0ms, 1ms, 2ms, 9ms or 18ms 4ms maximum plus filter time
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22 ms, without activation)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)(1)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

(1)Maximum wire size will require extended housing - 1756-TBE.

Table 5.P 10-31V dc 32 Point Digital Input Module Cat. No. 1756-IB32 Specifications

1756-IB32 Specifications	
Number of Inputs	32 (16 points/common)
Backplane Current	150mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.81W)
Maximum Power Dissipation (Module)	4.5W @ 60ºC
Thermal Dissipation	16.37 BTU/hr @ 60ºC
On-State Voltage Range	10-31.2V dc
Nominal Input Voltage	24V dc
On-State Current	2mA @ 10V dc minimum 5.5 mA @ 31.2V dc maximum
Maximum Off-State Voltage	5V dc
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 31.2V dc	5.67kW
Input Delay Time Off to on Hardware delay On to off Hardware delay	 Programmable filter: 0ms, 1ms or 2ms 1ms maximum plus filter time Programmable filter: 0ms, 1ms, 2ms, 9ms or 18ms 2ms maximum plus filter time
Diagnostic Functions Change of state Time stamp on inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100ms minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

Table 5.Q 159-256V ac 16 Point Isolated Digital Input Module Cat. No. 1756-IM16I Specifications

1756-IM16I Specifications	
Number of Inputs	16 (Individually isolated)
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation	5.8W @ 60°C
Thermal Dissipation	19.78 BTU/hr
On-State Voltage Range	159-265V ac, 47-63Hz @ 30°C All Channels ON 159-265V ac, 47-63Hz @ 40°C 8 Points ON 159-253V ac, 47-63Hz @ 45°C All Channels ON 159-242V ac, 47-63Hz @ 60°C All Channels ON
Nominal Input Voltage	240V ac
On-State Current	5mA @ 159V ac, 60Hz minimum 13mA @ 265V ac, 60Hz maximum
Maximum Off-State Voltage	40V ac
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 265V ac	20.38kΩ @ 60Hz
Input Delay Time Off to on Hardware delay On to off Hardware delay	 Programmable filter: 1ms or 2ms 10ms maximum plus filter time Programmable filter: 9ms or 18ms 8ms maximum and filter time
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)(1)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

(1)Maximum wire size will require extended housing - 1756-TBE.

Table 5.R 74-265V ac 16 Point Digital Output Module Cat. No. 1756-OA16 Specifications

1756-OA16 Specifications	
Number of Outputs	16 (8 points/common)
Backplane Current	400mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 2.09W)
Maximum Power Dissipation (Module)	6.5W @ 60°C
Thermal Dissipation	22.17 BTU/hr
Output Voltage Range	74-265V ac, 47-63Hz
Output Current Rating Per Point Per Group Per Module	 0.5A maximum @ 60°C 2A maximum @ 60°C 4A maximum @ 60°C
Surge Current Per Point Per Group	 8A for 43ms each, repeatable every 2s @ 60°C 15A for 43ms each, repeatable every 2s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V @ 0.5A 5.7V @ load current < 50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/µs for loads>50mA 0.2V/µs for loads<50mA(1)
Output Delay Time Off to on On to off	 9.3ms @ 60Hz: 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Diagnostic Functions Fuse Blown Time stamp of diagnostics	 1 Fuse and indicator/group +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 60V peak
Fusing	Mechanically fused/group 3.15A @ 250V ac slow blow 1500A interruption current Littelfuse p/n H2153.15
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable

Table 5.R 74-265V ac 16 Point Digital Output Module Cat. No. 1756-OA16 Specifications

1756-OA16 Specifications cont.	
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[2]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Commutating dv/dt of output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50mA. Commutating dv/dt rating of module for loads 50-500mA (OUTPUT TO L2) is 4V/µs maximum. If commutating dv/dt rating of TRIAC is exceeded, TRIAC could latch on. If commutating dv/dt rating is exceeded in 10-50mA range, a resistor may be added across the output and L2. The purpose of resistor is to increase total output current to 50mA (I=V/R). At 50mA and above, module has a higher commutating dv/dt rating. When adding a resistor for the output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If commutating dv/dt rating is exceeded in 50-500mA range, L1 AC waveform could be at fault. Be sure waveform is a good sinusoid, void if any anomalies such as distorted or flattened sections.

[2] Maximum wire size will require extended housing - 1756-TBE.

Table 5.S 74-265V ac 16 Point Isolated Output Module Cat. No.1756-OA16I Specifications

1756-OA16I Specifications	
Number of Outputs	16 (individually isolated)
Backplane Current	300mA @ 5.1V dc & 2.5mA @ 24V dc (Total backplane power 1.6W)
Maximum Power Dissipation (Module)	5.5W @ 60°C
Thermal Dissipation	18.76 BTU/hr
Output Voltage Range	74-265V ac, 47-63Hz
Output Current Rating Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 5A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	20A for 43ms each, repeatable every 2s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V peak @ 2A & 6V peak @ load current<50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/µs for loads>50mA 0.2V/µs for loads<50mA[1]
Output Delay Time Off to on On to off	 9.3ms @ 60Hz; 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 60V peak
Fusing	Not protected - Fused IFM is recommended to protect outputs (See publication 1492-2.12)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[2]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Commutating dv/dt of output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50mA. Commutating dv/dt rating of module for loads 50-500mA (OUTPUT TO L2) is 4V/µs maximum. If commutating dv/dt rating of TRIAC is exceeded, TRIAC could latch on. If commutating dv/dt rating is exceeded in the 10-50mA range, a resistor may be added across the output and L2. The purpose of this resistor is to increase total output current to 50mA (I=V/R). At 50mA and above, module has a higher commutating dv/dt rating. When adding a resistor for the output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If commutating dv/dt rating is exceeded in the 50-5 00mA range, L1 AC waveform could be at fault. Be sure the waveform is a good sinusoid, void if any anomalies such as distorted or flattened sections.

[2] Maximum wire size will require extended housing - 1756-TBE.

Table 5.T 74-132V ac 8 Point Diagnostic Output Module Cat. No. 1756-OA8D Specifications

1756-OA8D Specifications	
Number of Outputs	8 (4 points/common)
Backplane Current	175mA @ 5.1V dc & 250mA @ 24V dc (Total backplane power 6.89W)
Maximum Power Dissipation (Module)	5.3W @ 60°C
Thermal Dissipation	18 BTU/hr
Output Voltage Range	74-132V ac, 47-63Hz
Output Current Rating Per Point Per Module	 1A maximum @ 30°C & 0.5A maximum @ 60°C (Linear derating) 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	8A for 43ms each, repeatable every 2s @ 30°C 5A for 43ms each, repeatable every 1s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	2.5V peak @ 0.5A & 3V peak @ 1A
Maximum Off-State Leakage Current	3mA per point
Output Delay Time Off to on On to off	 9.3ms @ 60Hz: 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Diagnostic Functions Short Trip No Load Output Verification Pulse Test Field Power Loss (Zero Cross) Time stamp of diagnostics	 12A for 500µs minimum Off state detection only On state detection only On and Off state detection Detects at 25V peak minimum (Firmware phase locked loop) +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 25V peak
Fusing	Electronically fused per point
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH[1])
Screwdriver Width for RTB	5/16 inch (8mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

Table 5.U 19-30V dc 16 Point Diagnostic Output Module Cat. No. 1756-OB16D Specifications

1756-OB16D Specifications	
Number of Outputs	16 (8 points/common)
Backplane Current	250mA @ 5.1V dc & 140mA @ 24V dc (Total backplane power 4.64W)
Maximum Power Dissipation (Module)	3.3W @ 60°C
Thermal Dissipation	11.25 BTU/hr
Output Voltage Range	19.2-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	4A for 10ms each, repeatable every 1s
Minimum Load Current	3mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 5ms maximum
Diagnostic Functions: Short trip No load Output verification Pulse test Time stamp of diagnostics	 8A 180ms minimum 10A 120ms minimum OFF STATE detection only ON STATE detection only On and Off state detection +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Electronically fused per point
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H[1])
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

Table 5.V 10-30V dc 16 Point Isolated Output Module Cat. No. 1756-OB16I Specifications

1756-OB16I Specifications	
Number of Outputs	16 (individually isolated)
Backplane Current	350mA @ 5.1V dc & 2.5mA @ 24V dc (Total backplane power 1.85W)
Maximum Power Dissipation (Module)	3.6W @ 60°C
Thermal Dissipation	12.28 BTU/hr
Output Voltage Range	10-30V dc
Output Current Rating Resistive:Per Point Per Module Inductive:Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating) 1A maximum @ 60°C 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	4A for 10ms each, repeatable every 2s
Minimum Load Current	1mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	0.5mA per point
Output Delay Time Off to on On to off	 1ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM is recommended to protect outputs (See publication 1492-2.12)
Reverse Polarity Protection	None (If module is wired incorrectly, outputs may be damaged.)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H[1])
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

Table 5.W 10-31V dc 32 Point Output Module Cat. No. 1756-OB32 Specifications

1756-OB32 Specifications	
Number of Outputs	32 (16 points/common)
Backplane Current	300mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.58W)
Maximum Power Dissipation (Module)	4.8W @ 60°C
Thermal Dissipation	16.37 BTU/hr
Output Voltage Range	10-31.2V dc @ 50°C (Linear derating) 10-28V dc @ 60°C
Output Current Rating Per Point Per Module	 0.5A maximum @ 50°C (Linear derating) 0.35A maximum @ 60°C 16A maximum @ 50°C (Linear derating) 10A maximum @ 60°C
Surge Current per Point	1A for 10ms each, repeatable every 2s @ 60°C
Minimum Load Current	3mA per point
Maximum On-State Voltage Drop	200mV dc @ 0.5A
Maximum Off-State Leakage Current	0.5mA per point
Output Delay Time Off to on On to off	 1ms maximum 1ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM is recommended to protect outputs (See publication 1492-2.12)
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H[1])
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
See Table 5.J on page 5-11 for specifications common to all 1756 digital I/O modules	

[1] Maximum wire size will require extended housing - 1756-TBE.

1756 Removable Terminal Blocks

Removable terminal blocks (RTBs) provide a flexible interconnection between your plant wiring and 1756 I/O modules. The RTB plugs into the front of the I/O module. The type of I/O module determines which RTB you need. You choose screw-clamp or spring-clamp RTBs.

RTBs are not shipped with I/O modules. You must order them separately. The standard housing on the front of the wiring arm is not deep enough for 14 AWG wiring. If you plan to use 14 AWG wiring, also order the extended housing.

Catalog number:	Description:	Weight:
1756-TBNH	screw-clamp with 20-pin connection	0.1 kg (0.3lb)
1756-TBSH	spring-clamp with 20-pin connection	0.1 kg (0.2lb)
1756-TBCH	screw-clamp with 36-pin connection	0.1 kg (0.3lb)
1756-TBS6H	spring-clamp with 36-pin connection	0.1 kg (0.2lb)
1756-TBE	extended housing; required for additional wiring space if using 14 AWG wiring	0.05 kg (0.1 lb)

1756 ControlNet Bridge

Table 5.X ControlNet Bridge Specifications

Specifications		1756-CNB	1756-CNBR
ControlNet Interface	connectors	• 1 BNC connector for non-redundant media operation • 1 NAP (RF_45 8-pin with shield)	• 2 BNC connectors for redundant media operation • 1 NAP (RF_45 8-pin with shield)
	cable	quad shield RG-6 coaxial cable	
	ground isolation	transformer	
Electrical	power dissipation	5.14 W	
	thermal dissipation	17.5 BTU/hr	
	backplane current	970 mA @ 5.1 V 1.7 mA @ 24 V	1.0 A @ 5.1 V 1.7 mA @ 24 V
Environmental	operational temperature	0 to 60°C (32 to 140°F)	
	storage temperature	–40 to 85°C (–40 to 185°F	
	relative humidity	5 to 95% (without condensation)	

Physical	location	any slot in a 1756 chassis	
	weight	0.260 kg (0.57 lb.)	0.293 kg (0.64 lb.)
Agency Certification (when product or packaging is marked)		Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Approved class I, Division 2, Group A,B,C,D Marked for all applicable directives Marked for all applicable acts N223	

For more information about the ControlLogix system, please see the ControlLogix Selection Guide, publication 1756-SG001.

ProcessLogix R320.0
Supported 1794 Series I/O Module Specifications

Rockwell Testing

During recent Rockwell testing of the 1794 series, we found the following:

- 1757-PLX52 can talk to a quantity of 64, assorted 1794 I/O modules in a scheduled environment using RSNetworx.
- 1757-PLX52 can to talk to a quantity of 59, assorted 1794 I/O modules, as well as a quantity of 5, 1797 Hazardous Rail I/O, in a scheduled environment using RSNetworx.

IMPORTANT Tested modules include: 1794-IE8, 1794-IA8, 1794-OE4, 1794-IR8, 1794-1794-IT8, 1794-OW8, 1794-OB16, 1794-IB16, 1794-OA8.

Common Specifications

See Table 6.A for specifications common to all 1794 modules (except when included in individual tables with notations)

Table 6.A Common Module Specifications

1794 Module Specifications	
Dimensions HxWxD	87mm x 68mm x 69mm (3.4in x 2.7in x 2.7in)
Environmental Conditions[1] Operational Temperature Storage Temperature Relative Humidity Shock Operating Non Operating Vibration	 0 to 55°C (32 to 131°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing 30g peak acceleration, 11(±)ms pulse width 50g peak acceleration, 11(±)ms pulse width Tested 5g @ 10-500Hz per IEC 68-2-6
Power Conductors Wire Size Category	 12 gauge (4mm²) stranded maximum, 3/64 (1.2mm) inch insulation maximum 2[2]
All modules in this chapter can be conformally coated for protection.	
Agency Certification	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Groups A, B, C, D or nonhazardous locations Marked for all applicable directives

[1] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

[2] Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

IMPORTANT This section contains only those modules that are currently supported by ProcessLogix R320.0. We offer many I/O modules not listed here and we continue to add support for I/O modules currently not supported.

For a complete listing of all our modules, refer to these publications:

- 2001 Rockwell Automation/Allen-Bradley Asset Management Catalog, SUPR-CA027A-EN-P
- Master Price List - USA, CIG-3.0

Module Specifications

The following tables list specifications for 1794-series I/O modules

Table 6.B 120V ac 8 Input Module Cat. No. 1794-IA8 Specifications

1794-IA8 Specifications	
Number of Inputs	8 (1 group of 8), non-isolated, sinking
Module Location	Cat. No. 1794-TBN, -TB3, or -TB3S Terminal Base Unit
ON-State Voltage (min)	65V ac
ON-State Current (min)	7.1mA
OFF-State Voltage (max)	43V ac
OFF-State Current (max)	2.9mA
Nominal Input Impedance	10.6K S
Nominal Input Current	12mA @ 120V ac, 60 Hz
Isolation Voltage: Channel to channel Customer power to input channels User to system	None None 100% tested at 2150V dc for 1s
Maximum Input Delay Time OFF to ON (time from a valid input signal to recognition by module) ON to OFF (time from input dropping below valid level by recognition by module)	 8.6ms, 9ms, 10ms, 12ms, 17ms, 26ms, 43ms, and 78ms 26.6ms, 27ms, 28ms, 30ms, 35ms, 44ms, 61ms, and 96ms 9Delay time selectable through output image table Default is 8.6 ms off to on/26.6 on to off
Flexbus Current (max)	30mA @ 5V dc
Power Dissipation	Maximum 4.5W @ 132V ac
Thermal Dissipation	Maximum 15.3 BTU/hr @ 132V ac
Indicators (field side indication, customer device driven)	8 yellow status indicators
Keyswitch Position	8

Table 6.B 120V ac 8 Input Module Cat. No. 1794-IA8 Specifications

External ac Power: Supply Voltage Voltage Range	120 V ac nominal 85 to 132V ac, 47-63Hz
Conductors Wire Size Category	12 gauge ($4mm^2$) stranded maximum 3/64 inch (1.2mm) insulation maximum 1(1)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.C 24V dc 16 Sink Input Module Cat. No. 1794-IB16 Specifications

1794-IB16 Specifications	
Number of Inputs	16 (1 group of 16), non-isolated, sinking
Module Location	Cat. No. 1794-TB3 or TB3S Terminal Base Unit
ON-Slate Voltage	10V dc minimum; 24V dc nominal; 31.2V dc maximum
ON-Slate Current	2.0mA minimum; 8.0mA nominal at 24V dc; 12.0mA maximum
OFF-Slate Voltage	5.0V dc maximum
OFF-Slate Current	1.5mA minimum
Input Impedance	4.6 Ω maximum
Isolation Voltage	100% tested at 850V dc for 1s between user and system No isolation between individual channels
Maximum Input Delay Times OFF to ON ON to OFF	 512ms, 1ms, 2ms, 4ms, 8ms, 16ms, 32ms, and 64ms 512ms, 1ms, 2ms, 4ms, 8ms, 16ms, 32ms, and 64ms 512ms default-selectable thru output image table
Flexbus Current (max)	30mA @ 5V dc
Power Dissipation	Maximum 6.1W @ 31.2V dc
Thermal Dissipation	Maximum 20.8 BTU/hr @ 31.2V dc
Indicators (field side indication, customer device driven)	16 yellow status indicators
Keyswitch Position	2
External dc Power Supply Voltage Voltage Range	 24V dc nominal 19.2 to 31.2 V dc (includes 5% ac ripple)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Table 6.D 24V dc 8 Source Output Module Cat. No. 1794-OB8 Specifications

1794-OB8 Specifications	
Number of Outputs	8 (1 group of 8) non-isolated, sourcing
Module Location	Cat. No. 1794-TB2, -TB3, or -TB3S Terminal Base Unit
ON-State Voltage Range	10V dc minimum 24V dc nominal; 31.2V dc maximum
ON-State Voltage Drop	0.5V dc maximum
ON-State Current	1.0mA minimum per channel 500mA maximum per channel
OFF-State Voltage	31.2V dc maximum
OFF-State Leakage	0.5mA maximum
Isolation Voltage (min)	100% tested at 850V dc for 1s between user and system No isolation between individual channels
Output Signal Delay OFF to ON ON to OFF	 0.5ms maximum 1.0ms maximum
Flexbus Current (max)	60mA
Power Dissipation	3.3W maximum @ 31.2V
Thermal Dissipation	11.2 BTU/hr @ 31.2V dc
Indicators (field side indication, logic driven)	8 yellow status indicators
Output Current Rating	4A (8 outputs @ 0.5A)
Surge Current	2A for 50ms, repeatable every 2s
Fusing	Module outputs are not fused. Fusing of outputs is recommended. If fusing is desired, you must provide external fusing, use SAN-O MQ4-800mA fuses.
Keyswitch Position	2
General Specifications	
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 25mA @ 24V dc (20 to 35mA)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Table 6.E 120V ac 8 Isolated Output Module Cat. No. 1794-OA8I Specifications

1794-OA8I Specifications	
Number of Outputs	8 individually isolated
Module Location	Cat. No. 1794-TBNF, -TB3, -TB3S, -TBN, or -TB2 Terminal Base Unit
Maximum On-State Voltage Drop	1.0V @ 0.5A
ON-State Current	5mA per output minimum 500mA per output maximum @ 55°C (sufficient to operate an A-B Bulletin 500 NEMA size 3 motor starter); 750mA per output maximum @ 35°C; 1.0A on 4 nonadjacent outputs, 500mA on the remaining 4 outputs @ 30°C
OFF-State Leakage	2.25mA maximum
Output Voltage Range	85-132V ac, 47-63Hz
Output Current Rating	4.0A (8 outputs @ 500mA)
Isolation Voltage	100% tested at 2100V dc for 1s between all channels and system 2100V dc for 1s between individual channels
Output Signal Delay OFF to ON ON to OFF	 1/2 cycle maximum 1/2 cycle maximum
Flexbus Current (max)	80mA
Power Dissipation	4.1W maximum @ 0.5A 6.3W maximum @ 0.75A 6.3W maximum @ 1.0A
Thermal Dissipation	14.0 BTU/hr @ 0.5A 21.1 BTU/hr @ 0.75A 21.4 BTU/hr @ 1.0/0.5A
Indicators (field side indication, logic driven)	8 yellow status indicators
Keyswitch Position	8
Surge Current	7A for 45ms, repeatable every 8 seconds
Fusing(1)	Use 1.6A, 250V ac Slow-Blow, Littelfuse pt. no. 23901.6; San-O SD6-1.6A; A-B pt. no. 94171304 (The 1794-TBNF fused terminal base comes with SD6-1.6A fuses installed.)
General Specifications	
External ac Power Supply Voltage Input Frequency Voltage Range Surge Current Capability	 120V ac nominal 47-63Hz 85 to 132V ac Maximum 50A for 1/2 cycle at powerup
Conductors Wire Size Category	12 gauge ($4mm^2$) stranded maximum 3/64 inch (1.2mm) insulation maximum 1[1]

See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules

(1) Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.F 120V ac 16 Output Module Cat. No. 1794-OA16 Specifications

1794-OA16 Specifications	
Module Location	Cat. No. 1794-TB3, -TB3S, -TBN, or -TB2 Terminal Base Unit
Module Mounting	See derating curve
Maximum On-State Voltage Drop	1.5V @ 0.5A
ON-State Current	50mA per output minimum 500mA per output maximum @ 55°C
OFF-State Leakage	2.25mA maximum
Output Voltage Range	74-132V ac, 47-63Hz
Output Current Rating	4.0A (16 outputs @ 250mA) Attention: If using 0.5A outputs, alternate wiring so that no two 0.5A outputs are next to each other.
Isolation Voltage	100% tested at 2150V ac for 1s between all channels and system No isolation between individual channels; No isolation between customer power and output channels
Output Signal Delay OFF to ON ON to OFF	 1/2 cycle maximum 1/2 cycle maximum
Flexbus Current (max)	80mA
Power Dissipation	4.7W maximum @ 0.5A
Thermal Dissipation	16.1 BTU/hr @ 0.5A
Indicators (field side indication, logic driven)	16 yellow status indicators
Keyswitch Position	8
Surge Current	7A per module, alternate wiring for 40ms, repeatable every 8 seconds
Fusing(1)	Use 2.5A, 150V ac MQ2 normal fuse
General Specifications	
External ac Power Supply Voltage Input Frequency Voltage Range	 120V ac nominal 47-63Hz 74 to 132V ac
Conductors Wire Size Category	12 gauge (4mm^2) stranded maximum 3/64 inch (1.2mm) insulation maximum 1(2)

See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules

(1) Module outputs are not fused. Fusing of outputs is recommended. If external fusing is desired, you must provide external fusing.

(2) Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.G 24V dc 16 Source Output Module cat. No. 1794-OB16 Specifications

1794-OB16 Specifications	
Number of Inputs	16 (1 group of 16), non-isolated, sourcing
Module Location	Cat. No. 1794-TB3 or TB3S Terminal Base Unit
ON-Slate Voltage Range	10V dc minimum; 24V dc nominal; 31.2V dc maximum
ON-Slate Voltage Drop	0.5V dc maximum
ON-Slate Current	1.0mA minimum; 500mA maximum per channel
OFF-Slate Voltage	31.2V dc maximum
OFF-Slate Leakage	01.5mA maximum
Isolation Voltage (min)	100% tested at 850V dc for 1s between user and system No isolation between individual channels
Output Signal Delay OFF to ON ON to OFF	 0.5ms maximum 1.0ms maximum
Flexbus Current (max)	80mA
Power Dissipation	5.3W maximum @ 31.2V dc
Thermal Dissipation	18.1 maximum BTU/hr @ 31.2V dc
Indicators (field side indication, customer device driven)	16 yellow status indicators
Output Current Rating	8A (16 outputs @ 0.5A) horizontal or vertical
Surge Current	2A for 50ms, repeatable every 2 seconds
Keyswitch Position	2
Fusing(1)	SAN-O MQ4-800 800mA fuses
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2 V dc (includes 5% ac ripple) 49mA @ 24V dc (38mA to 65mA)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Module outputs are not fused. Fusing of outputs is recommended. If external fusing is desired, you must provide external fusing.Use this conductor category information for planning conductor routing.

Table 6.H 24V dc 16 Source Output (Protected) Module Cat. No. 1794-OB16P Specifications

1794-OB16P Specifications	
Number of Outputs	16 (1 group of 16), non-isolated, sourcing
Module Location	Cat. No. 1794-TB2, -TB3, or -TB3S Terminal Base Unit
ON-State Voltage Range	10V dc minimum 24V dc nominal; 31.2V dc maximum
ON-State Voltage Drop	0.5V dc maximum
ON-State Current	1.0mA minimum per channel 500mA maximum per channel
OFF-State Voltage	31.2V dc maximum
OFF-State Leakage	0.5mA maximum
Isolation Voltage (min)	100% tested at 2121V dc for 1s between user and system No isolation between individual channels
Output Signal Delay OFF to ON ON to OFF	 0.5ms maximum 1.0ms maximum
Flexbus Current (max)	60mA
Power Dissipation	5.0W maximum @ 31.2V
Thermal Dissipation	17.0 BTU/hr @ 31.2V dc
Indicators (field side indication, logic driven)	16 yellow status indicators
Output Current Rating	8A (16 outputs @ 0.5A)
Surge Current	1.5A for 50ms, repeatable every 2s
Keyswitch Position	2
Fusing	Outputs are electronically protected
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 10 to 31.2V dc (includes 5% ac ripple) 60mA @ 24V dc (25mA to 75mA) (Refer to the Derating Curve below)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Table 6.I 24V dc 16 Sink Output Module Cat. No. 1794-OV16 Specifications

1794-OV16 Specifications	
Number of Outputs	16 (1 group of 16), non-isolated, sinking
Module Location	Cat. No. 1794-TB3 or TB3S Terminal Base Unit
ON-State Voltage Range	10V dc minimum; 24V dc nominal; 31.2V dc maximum
ON-State Voltage Drop	0.2V dc maximum
ON-State Current	1.0mA minimum per channel 500mA maximum per channel
OFF-State Voltage	31.2V dc maximum
OFF-State Leakage	0.5mA maximum
Isolation Voltage (min)	100% tested at 2121V dc for 1s between user and system No isolation between individual channels
Output Signal Delay: OFF to ON ON to OFF	 0.5ms maximum 1.0ms maximum
Flexbus Current (max)	80mA
Power Dissipation	4.2W maximum @ 31.2V
Thermal Dissipation	14.3 BTU/hr @ 31.2V dc
Indicators (field side indication, customer device driven)	16 yellow status indicators
Output Current Rating	8A (16 outputs @ 0.5A)
Surge Current	2A for 50ms, repeatable every 2 seconds
Keyswitch Position	2
Fusing(1)	SAN-O MQ4-800 800mA fuses
External dc Power: Supply Voltage Voltage Range Supply Current	24V dc nominal 19.2 to 31.2 V dc (includes 5% ac ripple) 49mA @ 24V dc (38mA to 65mA)
Environmental Conditions Operational Temperature Storage Temperature Relative Humidity Shock Operating Non-operating Vibration	 0 to 55°C (32 to 131°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing 30g peak acceleration, 11(±1)ms pulse width 50g peak acceleration, 11(±1)ms pulse width Tested 5g @ 10-500Hz per IEC 68-2-6
Conductors Wire Size Category	12 gauge ($4mm^2$) stranded maximum 3/64 inch (1.2mm) insulation maximum 2(2)

See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules

(1) Module outputs are not fused. Fusing of outputs is recommended. If external fusing is desired, you must provide external fusing.

(2) Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.J 24V dc 16 Sink Output (Protected) Module Cat. No. 1794-OV16P

1794-OIV16P Specifications	
Number of Outputs	16 (1 group of 16), non-isolated, sinking
Module Location	Cat. No. 1794-TB3 or -TB3S Terminal Base Unit
ON-State Voltage Range	10V dc minimum 24V dc nominal; 31.2V dc maximum
ON-State Voltage Drop	0.2V dc maximum
ON-State Current	1.0mA minimum per channel 500mA maximum per channel
OFF-State Voltage	31.2V dc maximum
OFF-State Leakage	0.5mA maximum
Isolation Voltage (min)	100% tested at 2121V dc for 1s between user and system No isolation between individual channels
Output Signal Delay OFF to ON ON to OFF	 0.5ms maximum 1.0ms maximum
Flexbus Current (max)	80mA
Power Dissipation	4.2W maximum @ 31.2V
Thermal Dissipation	14.3 BTU/hr @ 31.2V dc
Indicators (field side indication, logic driven)	16 yellow status indicators
Output Current Rating	8A (16 outputs @ 0.5A)
Surge Current	2A for 50ms, repeatable every 2s
Keyswitch Position	2
Fusing	Outputs are electronically protected
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 49mA @ 24V dc (38mA to 65mA)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Table 6.K 120V ac 8 Output Module Cat. No. 1794-OA8 Specifications

1794-OA8 Specifications	
Number of Inputs	8 (1 group of 8), non-isolated, sinking
Module Location	Cat. No. 1794-TBNF, -TB3, or -TB3S or TBN Terminal Base Unit
Maximum On-State Voltage Drop	1.0V @ 0.5A
ON-State Current	50mA per output minimum 500mA per output maximum @ 55°C (sufficient to operate an A-B Bulletin 500 NEMA size 3 motor starter); 750mA per output maximum @ 35 °C; 1.0A on 4 nonadjacent outputs, 500mA on the remaining 4 outputs @ 30 °C
OFF-State Leakage	2.25mA maximum
Output Voltage Range	85-132V ac mn nfgfgvfvfgfffffd nn8iiol;II, 47-63Hz
Output Current Rating	4.0A (8 outputs @ 500mA)
Isolation Voltage	tested at 1250V ac for 1s between user and system No isolation between individual channels; No isolation between customer power and output channels
Output Signal Delay OFF to ON ON to OFF	 1/2 cycle maximum 1/2 cycle maximum
Flexbus Current (max)	80mA
Power Dissipation	5.2W maximum @ 132V ac
Thermal Dissipation	17.8 BTU/hr @ 132V ac
Indicators (field side indication, customer device driven)	8 yellow status indicators
Keyswitch Position	8
Surge Current	7A for 45ms, repeatable every 8 seconds
Fusing(1)	1.6A, 250V ac Slow-Blow (Littelfuse pt. no. 23901.6; SAN-O SD6-1.6A)
External ac Power Supply Voltage Input Frequency Voltage Range Supply Current Surge Current Capability	 120 V ac nominal 47-63Hz 85 to 132V ac 150mA minimum Maximum 50A for 1/2 cycle at powerstop
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Module outputs are not fused. Fusing of outputs is recommended. If external fusing is desired, use the 1794-TBNF fused terminal base unit.

Table 6.L 24V dc Selectable Analog 8 Input Module Cat. No. 1794-IE8/B Specifications

1794-IE8/B Specifications	
Number of Inputs	8 single-ended, non-isolated
Module Location	Cat. No. 1794-TB3 or TB3S Terminal Base Unit
Input Current Terminal	4-20mA (user configurable) 0-20mA (user configurable)
Input Voltage Terminal	± 10V (user configurable) 0-10V (user configurable)
Resolution Voltage Current	12 bits - unipolar; 11 bits plus sign - bipolar 2.56mV/cnt unipolar; 5.13mV/cnt bipolar 5.13mA/cnt
Input Impedance Voltage Terminal Current Terminal	 100kW 238W
Input Resistance Voltage Terminal Current Terminal	 200kW 238W
Isolation Voltage	Tested at 850V dc for 1s between user and system No isolation between individual channels
Flexbus Current	20mA @ 5V dc
Power Dissipation	3W maximum @ 31.2V dc
Thermal Dissipation	Maximum 10.2 BTU/hr @ 31.2V dc
Indicators	1 green power indicator
Keyswitch Position	3
Data Format	Left justified 16-bit 2's complement
Conversion Type	Successive approximation
Conversion Rate	256ms all channels
Normal Mode Rejection Ratio Voltage Terminal Current Terminal	 -db @ 17Hz;-20db/decade -10.0db @ 50Hz, -11.4db @ 60Hz -3db @ 9Hz; -20db/decade -15.3db @ 50Hz, -16.8dB @ 60Hz
Calibration	None Required
Step Response to 63% Voltage Terminal Current Terminal	 9.4ms 18.2ms
Absolute Accuracy(1) Voltage Terminal Current Terminal	 0.20% Full Scale @ 25°C 0.20% Full Scale @ 25°C
Accuracy Drift w/Temp. Voltage Terminal Current Terminal	 0.00428% Full Scale/°C 0.00407% Full Scale/°C
Maximum Overload	30V continuous or 32mA continuous, 1 channel at a time
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2 V dc (includes 5% ac ripple) 60mA @ 24V dc
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Includes offset, gain, non-linerity and repeatability error terms.

Table 6.M 24V dc Selectable Analog 4 Output Module Cat. No. 1794-OE4/B Specifications

1794-OE4/B Specifications	
Number of Outputs	4 single-ended, non-isolated
Module Location	Cat. No. 1794-TB3 or TB3S or -TBN Terminal Base Unit
Resolution Voltage Current	12 bits plus sign 2.56mV/cnt 5.13mA/cnt
Date Format	Left justified 16-bit 2's complement
Conversion Type	Pulse Width Modulation
Conversion Rate	1.024ms maximum all channels
Output Current Terminal	0mA output until module is configured 4-20mA user configurable 0-20mA user configurable
Step Response to 63% of FS	24ms
Current Load on Voltage Output	Maximum 3mA
Resistive Load on mA Output	15 - 750Ω
Absolute Accuracy(1) Voltage Terminal Current Terminal	 0.133% Full Scale @ 25°C 0.425% Full Scale @ 25°C
Accuracy Drift with Temperature Voltage Terminal Current Terminal	 0.0045% Full Scale/°C 0.0069% Full Scale/°C
Calibration	None Required
Isolation Voltage	Tested at 850V dc for 1s between user and system No isolation between individual channels
Indicators	1 green power indicator
Flexbus Current	20mA @ 5V dc
Power Dissipation	Maximum 4.5W @ 31.2V dc
Thermal Dissipation	Maximum 15.3 BTU/hr @ 31.2V dc
Keyswitch Position	4
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2 V dc (includes 5% ac ripple) 70mA @ 24V dc (not including outputs)
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Includes offset, gain, non-linearity and repeatability error terms.

Table 6.N 24V dc, 48V dc, 120V ac, and 240V ac 8 Relay Sink/Source Output Module Cat. No. 1794-OW8 Specifications

1794-OW8 Specifications	
Outputs per module	8 Form A isolated (normally open) electromechanical relays
Module Location	Cat. No. 1794-TBNF, -TB3, -TB3S, or -TBN Terminal Base Unit
Off-State Leakage Current (max at 240V ac)	1 mA through snubber circuit
Output Voltage Rating (load dependent)	5-30V dc @ 2.0A resistive 48Vdc @ 0.5A resistive 125V dc @ 0.25 resistive 125V ac @ 2.0A resistive 240V ac @ 2.0A resistive
Output Current Rating (at rated power)	Resistive 2A @ 5-30V dc 0.5A @ 48V dc 0.25A @ 125V dc 2A @ 125V ac 2A @ 240V ac Inductive 2.0A steady state @ 5-30V dc, L/R=7ms 0.5A steady state @ 48V dc, L/R=7ms 0.25A steady state @ 125V dc, L/R=7ms 2.0A steady state, 15A make @ 125V ac, PF=cos 0=0.4 2.0A steady state, 15A make @ 240V ac, PF=cos 0=0.4
Power Rating (steady state)	250W max. for 125V ac resistive output 480W max. for 240V ac resistive output 60W max. for 30V dc resistive output 24W max. for 48V dc resistive output 31W max. for 125V dc resistive output 250VA max. for 125V ac inductive output 480VA max. for 240V ac inductive output 60VA max. for 30V dc inductive output 24VA max. for 48V dc inductive output 31VA max. for 125V dc inductive output
Isolation Voltage Between any 2 sets of Contacts Customer load to logic Customer load to 24V dc supply Customer 24V dc supply to logic	 tested to 2550V dc for 1s tested to 2550V dc for 1s tested to 2550V dc for 1s tested to 850V dc for 1s
Output Signal Delay OFF to ON ON to OFF	 8ms maximum (time from valid output on signal to relay energization by module) 26ms maximum (time from valid output off signal to relay de-energization by module)
Flexbus Current (max)	69mA @ 5V dc
Power Dissipation	Maximum 5.5W
Thermal Dissipation	Maximum 18.8 BTU/hr
Indicators (field side indication, logic driven)	8 yellow status indicators
Keyswitch position	9

Table 6.N 24V dc, 48V dc, 120V ac, and 240V ac 8 Relay Sink/Source Output Module Cat. No. 1794-OW8 Specifications

1794-OW8 Specifications	
Initial Contact Resistance	30m
Switching Frequency	1 operation/3s (0.3Hz at rated load) max
Operated/Release Time	Maximum 10ms
Bounce Time	1.2ms (mean)
Minimum Contact Load	100uA at 100mV dc
Expected Life of Electrical Contacts	Minimum 100,000 operations @ rated loads
Fusing(1)	Use a 1794-TBNF with a 3.0A Littelfuse 239003
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 125mA maximum
Conductors Wire Size Category	 12 gauge (4mm^2) stranded maximum 3/64 inch (1.2mm) insulation maximum 1(2)
Agency Certification	Meets UL R150 and C300; Meets IEC 1131 AC-15 Utilization Category
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

(1) Module outputs are not fused. If external fusing is desired, you must provide external fusing.

(2) Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.0 24V dc 8 Input RTD Module Cat. No. 1794-IR8 Specifications

1794-IR8 Specifications	
Number of Inputs	8 Channels
Module Location	Cat. No. 1794-TB3, -TB3S, or -TB3T Terminal Base Unit
Signal Input Range	1 to 433
Sensors Supported	Resistance: 100 Pt =0.00385 Euro (-200 to +870 C) 100 Pt =0.003916 U.S. (-200 to +630 C) 200 Pt =0.00385 Euro (-200 to +630 C) 500 Pt =0.00385 Euro (-200 to +630 C) 100 Nickel =0.00618 (-60 to +250 C) 120 Nickel =0.00627 (-60 to +250 C) 200 Nickel =0.00618 (-60 to +250 C) 500 Nickel =0.00618 (-60 to +250 C) 10 Copper =0.00427 (-2000 to +260 C)
Resolution	16 bits across 435
Data Format	Left justified 16-bit 2's complement or offset binary
Normal Mode Noise Rejection	60db @ 60Hz for A/D filter cutoff @ 15Hz
Accuracy without Calibration (low humidity)	Normal mode: 0.05% Full Scale (maximum) Enhanced Mode: 0.01% Full Scale (typical)
Common Mode Rejection	-120db @ 60Hz; -100db @ 50Hzwith A/D filter cutoff @ 10Hz
Common Mode Voltage	0V between channels (common return)
System Throughput Normal mode: Enhanced mode:	 Programmable from 28ms/channel to 325ms/channel 325ms (1 channel scanned) 2.6s (8 channels scanned) Programmable from 56ms/channel to 650ms/channel 650ms (1 channel scanned) 2.925s (8 channels scanned)
Setting Time to 100% of Final Value	Available at system throughput rate
Open RTD Detection	Out of range reading (upscale)
Open Wire Detection Time	Available at system throughput rate
Overvoltage Capaability	35V dc continuous @ 25 C 250V peak transient
Channel Bandwidth	dc to 2.62Hz (-3db)
RFI Immunity	Error of less than 1% of range at 10V/M 27 to 1000MHz
Input Offset Drift with Temperature	1.5 m / C maximum
Gain Drift with Temperature	Normal mode: 20ppm/ C maximum Enhanced mode: 10ppm/ C maximum
RTD Excitation Current	718.39uA

Table 6.O 24V dc 8 Input RTD Module Cat. No. 1794-IR8 Specifications

Indicators	1 red/green status indicator
Flexbus Current	20mA
Power Dissipation	3W maximum @ 31.2V dc
Thermal Dissipation	Maximum 10.2 BTU/hr @ 31.2V dc
Keyswitch Position	3
Cable Requirements	2-wire Belden 9501 3-wire, less than 100 ft (30.5m) with normal humidity-Belden 9533 3-wire, greater than 100ft (30.5 m) or high humidity (>55% for >8 hrs) - Belden 83503
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 19.2V dc for ambient temperatures <55 C 24V dc for ambient temperatures <55 C 31.2V dc for ambient temperatures <40 C See derating curve. 10mA @ 24V dc
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Table 6.P 24V dc 8 Input Thermocouple/mV Module Cat. No. 1794-IT8 Specifications

1794-IT8 Specifications	
Use a 1794-TB3 or -TB3S terminal base unit for mV inputs only. You must use a 1794-TB3T terminal base unit when using thermocouple inputs.	
Number of Inputs	8 Channels
Module Location	Cat. No. 1794-TB3T Terminal Base Unit
Nominal Input Voltage Ranges	76.5mV
Supported Thermocouple Types	**Type B:** 300 to 1800 °C (572 to 3272 °F) **Type C:** 0 to 2315 °C (32 to 4199 °F) **Type E:** -270 to 1000 °C (-454 to 1832 °F) **Type J:** -210 to 1200 °C (-346 to 2192 °F) **Type K:** -270 to 1372 °C (-454 to 2502 °F) **Type L:** -175 to 800 °C (-283 to 1472 °F) **Type N:** -270 to 1300 °C (-450 to 2372 °F) **Type R:** -50 to 1768 °C (-58 to 3214 °F) **Type S:** -50 to 1768 °C (-58 to 3214 °F) **Type T:** -270 to 400 °C (-450 to 752 °F)
Resolution	16 bits (2.384 uV typical)
Accuracy with filter	0.025% Full Scale Range 0.5 C maximum
Accuracy without filter	0.05% Full Scale Range 0.5 C maximum
Data Format	16-bit 2's complement or offset binary (unipolar)
Normal Mode Noise Rejection	-60db @ 60Hz
Common Mode Rejection	-115db @ 60Hz; -100db @ 50Hz
Common Mode Input Range	10V maximum
Channel to Channel Isolation	10V
System Throughput	325ms (1 channel scanned), programmable to 28ms 2.6s (8 channels scanned), programmable to 224ms
Setting Time to 100% of Final Value	Available at system throughput rate
Open Circuit Detection	Out of range reading (upscale)
Open Thermocouple Detection Time	Available at system throughput rate
Overvoltage Capability	35V dc, 25V ac continuous @ 25 C 250V peak transient
Channel Band width	0 to 2.62Hz (-3db)
RFI Immunity	Error of less than 1% of range at 10V/M 27 to 1000MHz
Input Offset Drift with Temperature	6 uV/ C maximum
Gain Drift with Temperature	10ppm/ C maximum
Overall Drift with Temperature	50ppm/ C of span (maximum)
Cold Junction Compensation Range	0 to 70 C
Cold Junction Compensator	A-B Part Number 969424-01
Indicators	1 red/green power/status indicator
Flexbus Current	20mA
Power Dissipation	3W maximum @ 31.2V dc
Thermal Dissipation	Maximum 10.2 BTU/hr @ 31.2V dc
Keyswitch Position	3
External dc Power Supply Voltage Voltage Range Supply Current	 24V dc nominal 19.2 to 31.2V dc (includes 5% ac ripple) 19.2V dc for ambient temperatures <55 C 24V dc for ambient temperatures <55 C 31.2V dc for ambient temperatures <40 C See derating curve. 140mA @ 24V dc
See Table 6.A on page 6 1 for specifications common to all 1794 I/O modules	

Terminal Base Compatibility Cross Reference

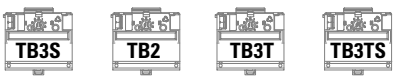
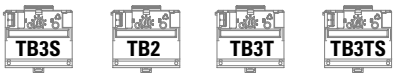
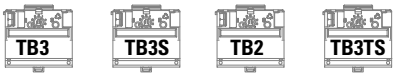
These terminal base units are plug and play modules. However, most terminal base units can be used with any module, but auxiliary terminal strips may be required.

The following table illustrates the recommended terminal base unit(s) for each module.

Table 6.Q Terminal Base Compatibility Cross Reference

		Module	Recommended	
	FLEX I/O Product	**Catalog Number**	**Recommended Base**	**Compatible Base(s)**
AC	120V ac Modules	1794-IA8		
		1794-OA8		
		1794-OA8I		
		1794-OA16		Auxiliary terminal strips are required when using the TBN for the OA16
		1794-IB16		
		1794-OB8		
		1794-OB16		
		1794-OB16P		
		1794-OV16		
		1794-OV16P		

Table 6.Q Terminal Base Compatibility Cross Reference

		Module	Recommended		
	FLEX I/O Product	**Catalog Number**	**Recommended Base**	**Compatible Base(s)**	
Analog	24V dc Modules	1794-IE8/B			
		1794-OE4/B			
		1794-IE4XOE2/B			
Relay	Relay Module	1794-OW8			
Specialty	RTD Input Module	1794-IR8			
	Thermocouple/mV Input Module	1794-IT8			You can use a TB2, TB3, or TB3S for mV inputs only.

Terminal Base Common Specifications

See Table 6.R for specifications common to all 1794 terminal bases (except when included in individual tables with notations)

Table 6.R Terminal Base Common Specifications

1794 Terminal Base Specifications	
Dimensions (with module installed in base) HxWxD	94mm x 94mm x 69mm (3.7in x 3.7in x 2.7in)
Environmental Conditions[1] Operational Temperature Storage Temperature Relative Humidity Shock Operating Non-Operating Vibration	 0 to 55°C (32 to 131°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing 30g peak acceleration, 11 (±1)ms pulse width 50g peak acceleration, 11(±1)ms pulse width Tested 5g @ 10-500Hz per IEC 68-2-6
Conductors Wire Size Category	12 gauge ($4mm^2$) stranded maximum 3/64 (1.2mm) inch insulation maximum (Established by inserted module)[2]
Agency Certification	Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Groups A, B, C, D or nonhazardous locations Marked for all applicable directives

[1] This product must be mounted within a suitable system enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool. This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating.

[2] Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Terminal Base Specifications

The following tables list terminal base specifications.

Table 6.S 2-wire Screw Clamp Terminal Base Cat. No. 1794-TB2 Specifications

1794-TB2 Specifications	
Number of Terminals	1 row of 16 1 row of 18 1 row of 2
Terminal Screw Torque	7-9 inch-pounds
Current Capacity	10A maximum
Voltage Rating	132V ac maximum
Isolation Voltage	Channel-to-channel isolation determined by inserted module (see publication 1794-5.2)
General Specifications	
ConductorsWire Size Category	12 gauge (4mm^2) stranded maximum 22 gauge (0.35mm^2) minimum 3/64 inch (1.2mm) insulation maximum 2[1]

[1] Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.T 3-wire Terminal Base Cat. No. 1794-TB3 Specifications

1794-TB3 Specifications	
Number of Terminals	1 rows of 16 2 rows of 18
Terminal Screw Torque	7-9 inch pounds
Current Capacity	10A maximum
Voltage Rating	132V ac maximum
Isolation Voltage	Channel-to-channel isolation determined by inserted module (see publication 1794-5.2)

Table 6.U 3-wire Spring Clamp Terminal Base Cat. No. 1794-TB3S Specifications

1794-TB3S Specifications	
Number of Terminals	1 row of 16 2 rows of 18
Terminal Type	Spring-clamp - To open, insert bladed screwdriver (0.100-0.120in/2.54-3.05mm) and lift up.
Current Capacity	10A maximum
Voltage Rating	132V ac maximum
Isolation Voltage	Channel-to-channel isolation determined by inserted module (see publication 1794-5.2)

Table 6.V Screw Clamp Temperature Terminal Base Cat. No. 1794-TB3T Specifications

1794-TB3T Specifications	
Number of Terminals	1 row of 16 2 rows of 18
Terminal Screw Torque	7-9 inch pounds
Current Capacity	10A maximum
Voltage Rating	132V ac maximum
Isolation Voltage	Channel-to-channel isolation determined by inserted module (see publication 1794-5.2)

Table 6.W Spring Clamp Terminal Base Unit Cat. No. 1794-TB3TS Specifications

1794-TB3TS Specifications	
Number of Terminals	1 row of 16; 2 rows of 18
Terminal Type	Spring-clamp - To open, insert bladed screwdriver (0.120-0.125in/2.54-3.05mm) and lift up.
Current Capacity	10A maximum
Voltage Rating	132V ac maximum
Isolation Voltage	Ch-to-ch isolation determined by inserted module
ConductorsWire Size Category	12 gauge ($4mm^2$) stranded maximum, 22 gauge ($0.35mm^2$) minimum 3/64 inch (1.2mm) insulation maximum 2[1]

[1] Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

Table 6.X Screw Clamp Grounded Terminal Base Unit Cat. No. 1794-TB3G Specifications

1794-TB3G Specifications	
Number of Terminals	1 row of 16; 2 rows of 18
Terminal Screw Torque	7-9 inch-pounds
Current Capacity	10A maximum
Voltage Rating	31.2V dc maximum
Isolation Voltage	Channel-to-channel isolation determined by inserted module

Table 6.Y Spring Clamp Grounded Terminal Base Cat. No. 1794-TB3GS Specifications

1794-TB3GS Specifications	
Number of Terminals	1 row of 16; 2 rows of 18
Terminal Type	Spring-clamp - To open, insert bladed screwdriver (0.100-0.120in/2.54-3.05mm) and lift up.
Current Capacity	10A maximum
Voltage Rating	31.2V dc maximum
Isolation Voltage	Ch-to-ch isolation determined by inserted module

Table 6.Z Terminal Base Unit Cat. No. 1794-TBN Specifications

1794-TBN Specifications	
Number of Terminals	2 rows of 10 terminals with cover
Terminal Screw Torque	7-9 inch pounds
Current Capacity	10A maximum
Voltage Rating	264V ac maximum
Isolation Voltage	Tested at 2500V dc for 1s between user terminals and logic side circuitry Channel-to-channel isolation determined by inserted module.

.

Table 6.AA Fused Terminal Base Cat. No. 1794-TBNF Specifications

1794-TBNF Specifications	
I/O Capacity	2 rows of 10 terminals with cover
Terminal Screw Torque	7-9 inch-pounds
Current Capacity	10A maximum
Voltage Rating	264V ac maximum
Isolation Voltage	Tested at 2500V dc for 1s between user terminals and logic side circuitry Channel-to-channel isolation determined by inserted module.
Fusing	8 - 5x20mm uses (1 for each even-numbered terminal - 0 through 14 on row B) Shipped with 1.6A, 250V ac Slow Blow fuses suitable for 194-OA8 ac output module. Refer to individual installation instructions for fusing recommendations for other modules.

Power Supply Specifications

The following tables list power supply specifications for 1794-series.

Table 6.AB Power Supply Cat. No. 1794-PS13 Specifications

1794-PS13 Specifications	
This power supply complies with the CE low-voltage directive.	
Mounting	Horizontal or vertical on a DIN rail, wall or panel
Nominal Supply Voltage	120V ac, 47-63Hz, 0.7A maximum 230V ac, 47-63Hz, 0.4A maximum
Voltage Range	85-265V ac
Inrush Current	30A for 1 ac cycle
Interruption	Output voltage will stay within specification when input drops out for 1/2 cycle @ 47Hz, 85V ac with maximum load
Nominal Output Voltage	+24V dc
Voltage Range	22.8-25.2V dc (includes noise & 5% ac ripple)
Output Current	1A maximum
Minimum Load	100mA
Output Surge	Sufficient to drive 3 adapters (surge of 23A for 2ms each)
Overvoltage Protection	Output internally limited to 35V dc. Cycle power to reenergize.
Isolation Voltage	tested to 1500V ac for 1 minute tested to 2500V dc for 1 second
Dimensions HxWxD	87mm x 68mm x 69mm (3.4in x 2.7in x 2.7in)
Environmental Conditions Operational Temperature Storage Temperature Relative Humidity Shock Operating Non-operating Vibration	 0 to 55 C (32 to 131 F) -40 to 85 C (-40 to 185 F) 5 to 95% noncondensing 30g peak acceleration, 11 (1)ms pulse width 50g peak acceleration, 11 (1)ms pulse width Tested 5g @ 10-500Hz per IEC 68-2-6
Conductors Wire Size Category	12 gauge (4mm) stranded maximum 3/64 inch (1.2mm) insulation maximum 1[(1)]
Agency Certification	CE Marked for all applicable directives

[(1)] Use this conductor category information for planning conductor routing. Refer to publication 1770-4.1, *Industrial Automation Wiring and Grounding Guidelines*.

ProcessLogix R320.0 Supported 1797 Series I/O Module Specifications

Rockwell Testing

During recent Rockwell testing of the 1797 series, we found the following:

- 1757-PLX52 can to talk to a quantity of 59, assorted 1794 I/O modules, as well as a quantity of 5, 1797 Hazardous Rail I/O, in a scheduled environment using RSNetworx.

IMPORTANT Tested modules include: 1797-IBN16, 1797-OB4D, 1797-IRT8, 1797-IE8, 1797-OE8

Common Specifications

See Table 7.A for specifications common to all modules (except when included in individual tables with notations).

Table 7.A Common Module Specifications

1797 Specifications	
IS Module Type	EEx ib IIB/IIC T4, AEx ib IIC T4, Class I Division 1 & 2 Groups A-D T4
Isolation Path	Isolation Type
Input to Power Supply	Galvanic to DIN EN50020
Input to Flexbus	Galvanic to DIN EN50020
Input to Input	None
Power Supply to Flexbus	Galvanic to DIN EN50020
Power Supply (+V, -V intrinsically safe)	$U_i \leq 9.5V$ dc $I_i \leq 1A$ L_i = Negligible C_i = Negligible

Table 7.A Common Module Specifications

1797 Specifications	
Dimensions (HxWxD)	46mm x 94mm x 75mm (1.8in x 3.7in x 2.95in)
Weight	200g (approximate)
Environmental Conditions Operational Temperature Storage Temperature Relative Humidity Shock Operating Non-Operating Vibration	 -20 to 70°C (-4 to 158°F) -40 to 85°C (-40 to 185°F) 5 to 95% noncondensing Tested 15g peak acceleration, 11 (±1)ms pulse width Tested 15g peak acceleration, 11 (±1)ms pulse width Tested 2g @ 10-500Hz per IEC 68-2-6
Agency Certification (when product or packaging is marked) CENELEC UL, C-UL FM	 II (1) 2G EEx ia/ib IIB/IIC T4 Class I Division 1 & 2 Groups A-D T4 Class I Zone 1 & 2 AEx ib/[ia] IIC T4 Class I Division 1 Groups A-D T4 Class I Zone 1 AEx ib/[ia] IIC T4
All modules in this chapter can be conformally coated for protection.	
Certificates CENELEC UL, C-UL FM	 CE UL UL Certificate Number 99.19699 FM APPROVED FM Certificate Number 3009806

IMPORTANT

This section contains only those modules that are currently supported by ProcessLogix R320.0. We offer many I/O modules not listed here and we continue to add support for I/O modules currently not supported.

For a complete listing of all our modules, refer to these publications:

- 2001 Rockwell Automation/Allen-Bradley Asset Management Catalog, SUPR-CA027A-EN-P
- Master Price List - USA, CIG-3.0

Module Specifications

The following tables lists specifications for 1797-series I/O modules.

Table 7.B 16 pt. Non-Isolated NAMUR Input Module Cat. No. 1797-IBN16 Specifications

1797-IBN16 Specifications	
Number of Inputs	16 (1 group of 16), non-isolated, sinking
IS Input Type	EEx ia IIB/IIC, AEx ia IIC T4, Class I, II, III Division 1 & 2 Groups A-G T4
Input Type	DIN19234, NAMUR compatible
ON-State Current	2.1mA
OFF-State Current	1.2mA
Hysteresis	0.2mA
Input Frequency	1000Hz maximum
Input Pulse Width	>500μs on or off
Maximum Load Voltage	U/V = 7.5V dc
Short Circuit Current	I = 7.5mA
Short Circuit Threshold	I > 6mA
Lead Breakage Threshold	I < 0.35mA
Input Delay Times	
OFF to ON	1ms, 2ms, 3ms, 5ms, 9ms, 17ms, 33ms
ON to OFF	1ms default - selectable thru output image table (see *Setting Input Filter Times*)
Indicators (field side indication, customer device driven)	16 yellow status indicators 16 red fault indicators 1 green module power indicator
Output (intrinsically safe) (16 pin male and female flexbus connector)	$U_i \leq 5.8V$ dc $I_i \leq 400mA$ L_i = Negligible C_i = Negligible
Module Field-Side Power Consumption	2.8W
Power Dissipation	2.8W
Thermal Dissipation	Maximum 9.6 BTU/hr
Module Location	Cat. No. 1797-TB3 or -TB3S Terminal Base Unit
Conductor Wire Size	12 gauge ($4mm^2$) stranded maximum 3/64in (1.2mm)insulation maximum
Keyswitch Position	6
Certificate	
CENELEC	DMT 98 ATEX E013 U
See Table 7.A on page 7-1 for specifications common to all 1797 I/O modules	

Table 7.C 24V dc 4 pt. Non-Isolated Source Output Module Cat. No. 1797-OB4D Specifications

1797-OB4D Specifications	
Number of Outputs	4, non-isolated, sourcing
IS Output Type	EEx ia IIB/IIC, AEx ia IIC T4, Class I, II, III Division 1 & 2 Groups A-G T4
V-I Characteristics	Refer to the "Output Voltage/Current Capability" section in 1797-5.6
Load Range	30-5000Ω
Fault Detection	Fault bits in data table and LED (per channel) blinking red (1 Hz)
Electronic Protection	Lead break, overload, short circuit
Maximum Output Delay Times	
OFF to ON	≤1.2ms
ON to OFF	≤1.2ms
Indicators	4 yellow status indicators 4 red fault indicators 1 green module power indicator
Output (Intrinsically Safe) (16 pin Male and Female Flexbus Connector)	$U_i \leq 5.8V$ dc $I_i \leq 400mA$ L_i = Negligible $C_i \leq 1.35\mu F$
Module Field-Side Power Consumption	7.5W
Power Dissipation	5W
Thermal Dissipation	17.07 BTU/hr
Module Location	Cat. No. 1797-TB3 or -TB3S Terminal Base Unit
Conductors Wire Size	12 gauge ($4mm^2$) stranded maximum 1.2mm (3/64in) insulation maximum
Keyswitch Position	7
Certificate	
CENELEC	DMT 98 ATEX E040 U
See Table 7.A on page 7-1 for specifications common to all 1797 I/O modules	

Table 7.D 8 pt. 16 bit Single-Ended Non-Isolated Input Module Cat. No. 1797-IE8 Specifications

1797-IE8 Specifications	
Number of Inputs	8 single-ended, non-isolated
IS Input Type	EEx ia IIB/IIC T4, AEx ia IIC T4, Class I, II, III Division 1 & 2 Groups A-G T4
Resolution	16 bits
Transfer Characteristics Accuracy at 20°C (68°F) Temperature Drift	 0.1% of input signal range 0.005%/C of input signal range
Functional Data Range	>15V @22mA >21V @ 0mA
Data Format	Configurable
Step Response to 99% of FS	4ms
Indicators	8 red fault indicators 1 green power
Output (Intrinsically Safe) (16 pin male and female flexbus connector)	$U_i \leq 5.8V$ dc $I_i \leq 400mA$ L_i = Negligible $C_i \leq 1.35\mu F$
Module Field-side Power Consumption	7.5W
Power Dissipation	5.2W
Thermal Dissipation	17.75 BTU/hr
Module Location	Cat. No. 1797-TB3 or -TB3S
Conductor Wire Size	12 gauge ($4mm^2$) stranded maximum 3/64in (1.2mm) insulation maximum
Keyswitch Position	3
Certificate CENELEC	 DMT 98 ATEX E020 U
See Table 7.A on page 7-1 for specifications common to all 1797 I/O modules	

Table 7.E 8 pt. 13 bit Single-Ended Non-Isolated Output Module Cat. No. 1797-OE8 Specifications

1797-OE8 Specifications	
Number of Outputs	8 single-ended, non-isolated
IS Output Type	EEx ia IIB/IIC T4, Aex ia IIC T4, Class I, II, III Division 1 & 2 Groups A-G T4
Resolution	13 bit
Transfer Characteristics	
Accuracy at 20°C (68°F)	0.1% of output signal range
Temperature Drift	0.010%/C of output signal range
Load Range	
Current	0-22mA
Voltage Available at 22mA	>11V
Load	0-500Ω @ 22mA
Data Format	Configurable
Step Response to 99% of FS	4ms
Indicators	8 red fault indicators 1 green power
Output (Intrinsically Safe) (16 pin male and female flexbus connector)	$U_i \leq 5.8V$ dc $I_i \leq 400mA$ L_i = Negligible $C_i = \leq 1.35\mu F$
Module Field-Side Power Consumption	6.3W
Power Dissipation	5.4W
Thermal Dissipation	18.4 BTU/hr
Module Location	Cat. No. 1797-TB3 or -TB3S Terminal Base Unit
Conductors Wire Size	12 gauge ($4mm^2$) stranded maximum 1.2mm (3/64in) insulation maximum
Keyswitch Position	4
Certificate	
CENELEC	DMT 98 ATEX E042 U
See Table 7.A on page 7-1 for specifications common to all 1797 I/O modules	

Table 7.F 8 pt. 16 bit Non-Isolated RTD Thermocouple/mV Input Module Cat. No. 1797-IRT8 Specifications

1797-IRT8 Specifications	
Number of Inputs	8 channels
IS Input Type	EEx ia IIB/IIC T4, AEx ia IIC T4, Class I, II, III Division 1 & 2 Groups A-G T4
Resolution	16 bits
Input Type	Suitable for Pt 100, Pt200, Ni 100, Ni120, Ni200, 10Cu RTD, thermocouple Type B, E, J, K, N, R, S, T, TXK/XK (L) Configuration via internal bus
Signal Input Range	0 to 500Ω; -40 to 100mV
Settling Time to 99% of Final Value	8ms (mV mode, ^{0}F thermocouple)
Open RTD Detection	Out of range upscale reading
Lead Resistance Compensation	< 15Ω total
Transfer Characteristics	
Accuracy	RTDs: 0.1% of span @ 20°C, filter cutoff < 1Hz Thermocouples: 0.1% of span @ 20°C, filter cutoff < 1Hz
Temperature Effect	Cold junction compensation = ±1°C 150ppm/°C (primary range)
Indicators	8 red fault indicators 1 green module power indicator
Data Organization Overrange Alarm	
Lead Breakage Alarm	Individually for each channel
Fault State	Individually for each channel
Sensor Mode RTD 2, 3, or 4-wire,	Individually for each channel (includes overrange, lead breakage and short circuit)
TC Sensor Type (e.g. TC, Type B, E, J..., RTD or mV	Common to groups of 4 channels (ch 0-3, ch 4-7)
Internal Reference Junction (TC mode)	Common to groups of 4 channels (ch 0-3, ch 4-7) Common to all channels (0°C, 20°C, 25°C, 30°C, 40°C, 50°C, 60°C, 70°C selectable
Output (intrinsically safe) (16 position male/female flexbus connector)	$U_i \leq 5.8V$ $I_i \leq 400mA$ Li = Negligible $Ci \leq 1.35\mu F$
Module Field-Side Power Consumption	1.6W
Power Dissipation	1.6W
Thermal Dissipation	Maximum 5.46BTU/hr
Module Location	Cat. No. 1797-TB3 or -TB3S Terminal Base Unit
Conductor Wire Size	12 gauge ($4mm^2$) stranded maximum 3/64in (1.2mm) insulation maximum
Keyswitch Position	2
Certificate	
CENELEC	DMT 98 ATEX E023 U
See Table 7.A on page 7-1 for specifications common to all 1797 I/O modules	

Terminal Base Specifications

You can use the 1797-TB3 terminal base unit with any module on the FLEX Ex system. Specific terminal function is governed by the I/O module itself. Check the installation instructions for each module to determine the specific terminal functions.

The following tables list terminal base specifications.

Table 7.G 3-Tier Screw Clamp Terminal Base Unit Cat. No. 1797-TB3 Specifcations

1797-TB3 Specifcations	
Termination connections are unique with each I/O module. Refer to the appropriate I/O module's installation instructions.	
Number of Terminals	1 row of 16, 2 rows of 18
Terminal Screw Torque	7-9 inch-pounds
Terminals Assignments +34, -35, +50, -51, and 96 pin female I/O connector pins 30-32, 62-64, 94-96	Only for intrinsically safe circuits U_i ≤10V dc I_i ≤2.5A C_i ≤1nF L_i Negligible
36, 49	Must not be used for any connection
All Other Terminals	U_i ≤30V dc I_i ≤100mA C_i ≤1nF L_i Negligible
Flexbus Connection Intrinsically Safe	U_i ≤10V dc I_i ≤400mA C_i ≤1nF L_i Negligible
Isolation Voltage	Channel-to-channel isolation determined by inserted module
Weight	200g (approximately)
Dimensions (with module installed in base) Inches Millimeters	 3.7H x 3.7W x 2.7D 94H x 94W x 69D

Table 7.G 3-Tier Screw Clamp Terminal Base Unit Cat. No. 1797-TB3 Specifcations

1797-TB3 Specifcations	
Environmental Conditions	
Operational Temperature	-20 to 70°C (-4 to 158°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5 to 95% noncondensing
Shock Operating	Tested 15g peak acceleration, 11 (±1)ms pulse width
Non-Operating	Tested 15g peak acceleration, 11 (±1)ms pulse width
Vibration	Tested 2g @ 10-500Hz per IEC 68-2-6
Conductors Wire Size	12 gauge ($4mm^2$) stranded maximum 1.2mm (3/64in) insulation maximumv
Agency Certification (when product or packaging is marked)	
CENELEC	II 2G EEx ia IIC T4
UL, C-UL	Class I Division 1 & 2 Groups A-D T4 Class I Zone 1 & 2 AEx ia IIC T4
FM	Class I Zone 1 AEx ia IIC T4
Certificates	
CENELEC	CE DMT 98 ATEX E012 U
UL, C-UL	UL Certificate Number 99.19699
FM	FM APPROVED FM Certificate Number 3009806

Power Supply Specifications

The following table lists power supply specifications.9999

Table 7.H FLEX Ex Power Supplies Cat. Nos. 1797-PS2N, and -PS2E Specifications

Specification	1797-PS2N	1797-PS2E
IS Module Type	Class I, Division 1 Groups C-D T4 Class I Division 2 Groups A-D T4	EEx de [ib] IIC T4
IS Output Type	EEx ib IIC, Class I, II, III Division 1 & 2 Groups A-G	
Input Connectors	24V dc Terminals 1, 2, 4, 5	
Voltage Range	19 to 32V	
Ripple	5% ac	
Input Power Entrance	1" NPT, ≤6" conduit allowed between power supply and seal	Increased safety
Output Connectors	Terminals 10-17	
Output Power	4x8.5W	
Voltage U_0	≤9.5V	
Current I_0	≤1A	
C_0 (IIC)	≤800 nF	
L_0 (IIC)	≤10 μH - Typical cable length 3.5m	
Maximum Output Cable Resistance (both directions)	≤0.1Ω	
Isolation Path		
Input Power to Output Power	Galvanic to DIN EN50020	
Output to Output	None	
Input Power	55W	
Power Dissipation	21W	
Thermal Dissipation	71.67 BTU/hr	

Table 7.H FLEX Ex Power Supplies Cat. Nos. 1797-PS2N, and -PS2E Specifications

Specification	1797-PS2N	1797-PS2E
Conductors Wire Size	12 gauge ($4mm^2$) stranded maximum 1.2mm (3/64in) insulation maximum Use wire rated for 100°C operation	
Dimensions (HxWxD)	174mm x 174mm x 128mm (6.9in x 6.9in x 5.04in)	174mm x 174mm x 280mm (6.9in x 6.9in x 11.0in)
Protections Class	IP66/NEMA 7B	IP 65/NEMA 7B
Weight (approximately)	7.3kg (16lbs)	7.7kg (17lbs)
Environmental Conditions		
Operational Temperature	-20 to 70°C (-4 to 158°F)	
Storage Temperature	-40 to 85°C (-40 to 185°F)	
Relative Humidity	5 to 95% noncondensing	
ShockOperating	Tested 15g peak acceleration, 11 (±1)ms pulse width	
Non-Operating	Tested 15g peak acceleration, 11 (±1)ms pulse width	
Vibration	Tested 2g @ 10-500Hz per IEC 68-2-6	
Agency Certifications (when product or packaging is marked)	UL Listed Industrial Control Equipment UL Listed Industrial Control Equipment for use in Canada Class I, Division 1 Groups C-D T4 Class I Division 2 Groups A-D T4 Marked for all applicable acts EEx de [ib] IIC T4 Marked for all applicable acts N223 BVS 98.D.2055X	

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